IBM Rochester Systems Lab Services
PowerHA Tools for IBM i

Full System FlashCopy Manager
Installation and Users Guide

July 30, 2019
Version 4.3

6

Introduction

The following picture shows an overview of the PowerHA Tools for IBM i – Full System Flash Copy (FSFC) relationships between various entities involved in a HA and/or DR architecture for an IBM i environment.

Overview of Full System Flashcopy topography
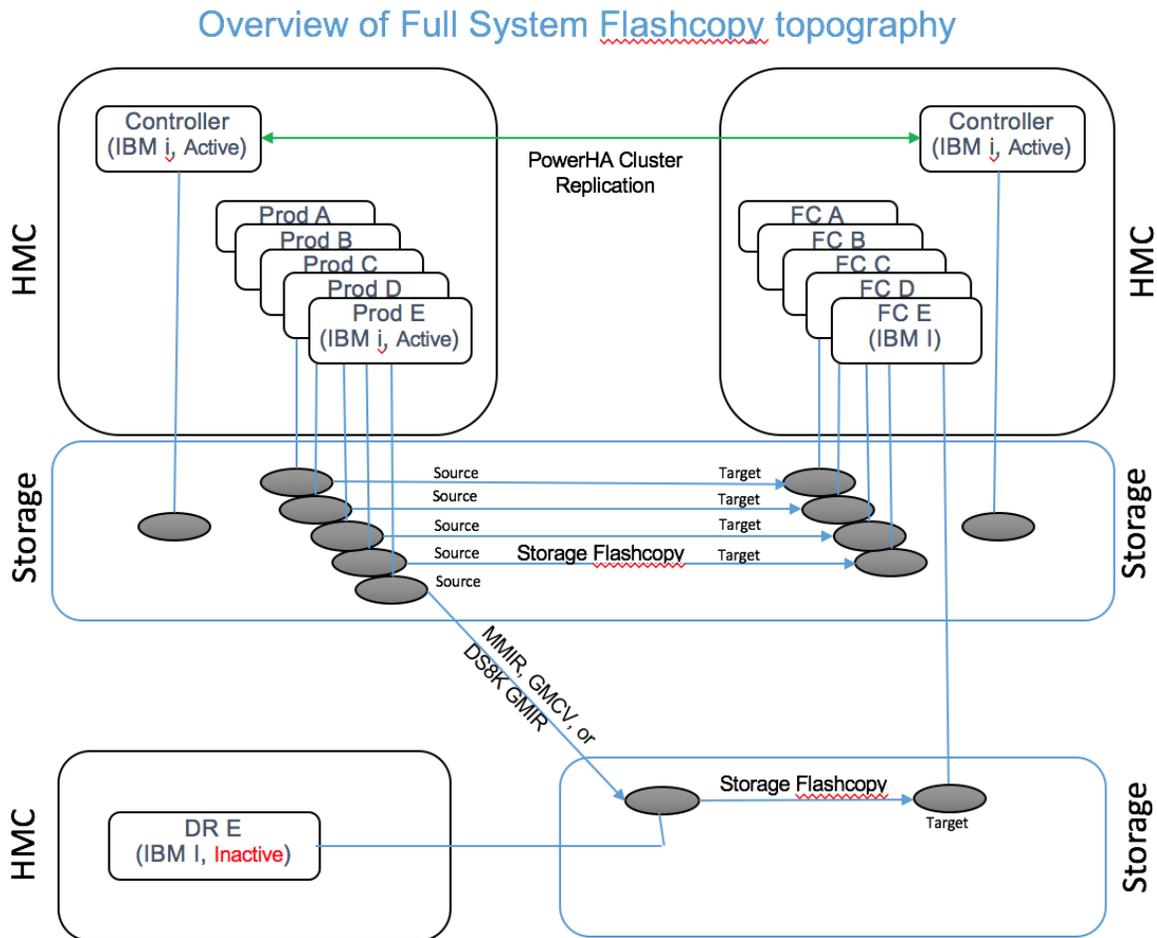
*It is recommended to have 2 Controlling LPAR(s)s, but the toolkit will function properly with one.

Note: Any reference to SVC in this document applies equally to V5000, V7000, V9000 and other Storewize products.

The Controllers manage the FlashCopy relationships. They communicate with the storage, HMC, source and Target LPARs. All FSFC configuration details are stored on the Controllers in PowerHA Device Data Domains. It is encrypted, as well as all communications with the production and Target LPARs. Communication with the HMC and storage is performed via ssh or DSCLI, which is also secured. Each controller is standalone, and using PowerHA they are kept synchronized.

The 'source' LPAR is usually the production LPAR, but other LPAR's (development, QA, etc) can also be the 'source' of a Flash Copy. The toolkit will perform several actions on the Source LPAR to prepare it for Flash Copy, such as flushing memory, holding database transaction, preparing BRMS, etc. When the Source LPAR is suspended in preparation for Flash Copy, it cannot communicate with the storage to trigger a FlashCopy, thus the controller is required to perform this task.

The 'target' LPAR is the one attached to the Flash Copy LUNs, and is usually used for backups, but can also be utilized for data mining, UAT, or any other purpose where a nearly identical copy of the Source LPAR is required.

Storwize products which include an SVC are supported. DS8K products are also supported. All other storage products (for example XIV or non-IBM storage) are supported when attached to an SVC as managed disks.

Flash Copy is a technology contained within one storage unit. Thin-provisioned / Space-efficient, full and incremental flashcopies are supported by the FSFC Toolkit. Remote Flash Copy is possible when using replication:

- DS8K and SVC synchronous (Metro Mirror) replication
- DS8K asynchronous (Global Mirror) replication
- SVC snapshot (Global Mirror w/Change Volumes) replication

SVC asynchronous (Global Mirror) replication without Change Volumes does not support remote Flash Copy.

What's new in 4.2

Full System Flash Copy was originally introduced at version 6.0 in an older family of the Copy Services Toolkit, and continued until version 7.70. The older toolkit did not require PowerHA. In 2017 we merged the 7.70 toolkit into our main family of toolkits (PowerHA Tools for IBM i) and switched to use the versioning sequence of that toolkit. That's why an upgrade from 7.70 yielded version 4.2.

Some literature refers the "Version 1" and "Version 2" of the toolkit. Version 1 included all releases of Copy Services Toolkit up to and including 7.70; Version 2 starts with 4.2.

These are the primary enhancement which were added to Version 4.2:

- Multiple Controlling LPAR(s)s for redundancy and resiliency
- All data stored and transferred is encrypted
- FlashCopy can be triggered from controlling or Source LPARs
- Simplified and improved interfaces and new commands for ease of use
- Less time required for deployment
- All communication is via IP addresses (no dependency on name resolution)
- Controller and Source toolkit code levels can be different for staging upgrades
- Improved platform for future features

- Integrated into same library (QZRDHASM) and release as IASP and Full System Replication Toolkits
- Use any DS8K user profile, not just QLPAR

Significantly, 4.2 requires PowerHA Standard Edition to be installed on the Controlling LPAR(s)s.

What's new in 4.3

Version 4.3 addressed several concerns our customers had:

- Support for more than approximately 11 FSR and FSFC CSE Data's. We have restructured how we use the PowerHA Device Data Domains and Cluster Resource Groups to allow the toolkit to create more CSE Data's. The upper limit is now in the thousands, far more than anyone would reasonable need to have. However, since the structure has changed, it is not compatible with 4.2 DDD's and CRG's. Upgrading from 4.2 to 4.3 will require recreating all the environments.
- Faster BRMS transfer speeds. Prior to version 4.3 we used a savefile to move BRMS from the flashcopy target to the source LPARs. The performance bottleneck was writing the records to the savefile in 528 records. FSFC 4.3 utilizes virtual tape instead, which sends all of its I/O through the IFS, and we are able to tailor the writes to 32k or 64k at a time, dramatically increasing the transfer rates. In our lab we have seen 5-6 times faster transfer rates, even including encrypting the data.
- Backwards compatibility. The toolkit philosophy is that the controller will be able to communicate with a production LPAR which is at most one release behind. Thus, a 4.3 controller can communication with a 4.2 or 4.3 production LPAR.
- Additional information is gathered during DMPINF to allow for validation of installation using just the zip file.
- Additional safeguards against the target LPAR starting the production LPAR startup program and coming online by modifying the startup program to call QZRDENDSBS.
- Recovery Flash Point allows the user to create frequent FlashCopies of the production LPAR for the purpose of recovery, not backups. This is a good option to create a point in time copy which can be used to protect against ransomware, corruption, or to provide a quick and easy way to revert to a pre-batch-processing state.
- Command SAVDDD/RSTDDD to save and restore Toolkit device data domains.

In addition, many minor tweaks and defects have been addressed. Please review the FSFC Wiki at http://ibm.biz/FSFC43Update for the latest updates.

Planning

Planning for FSFC installation is part of the services engagement associated with purchasing this product. This includes ensuring that all requirements/restrictions are followed. An overview of the Requirements and Restrictions is included below.

Requirements

Prior to the start of installation, the services representative must ensure the following requiremens have been met:

IBM i Release	IBM i Copy Services Manager for Power HA on i 4.3
i 7.1	Preferred
i 7.2	Preferred
i 7.3	Preferred
I 7.4	Preferred

External Storage Requirements:

- Source and Target LPARs must have 100% of SYSBAS on supported storage devices
  - DS8K family
  - Storwize (SVC) family, including V3700, V5000, V7000 and V9000
  - Other storage is supported if managed by an SVC
- Host connections must be NPIV or direct attach
  - vSCSI is not supported
- Flash Copy licensed on the storage device
- Replication licensed on the storage device if using replication
- Storwize units have a max of 32 simultaneous connections.
  - Each GUI browser and FSFC process consumes at least one connection

HMC Requirements:

- An HMC is required to manage the LPARs
  - FSM or ISV is not supported without an HMC
- At least one Controlling LPAR(s) is required

IBM i Requirements:

- IP address for Target LPAR if transferring BRMS information back to Source LPAR

Controlling LPAR(s) Requirements

The Controlling LPAR(s)s must meet the following requirements:

- CPU: >= 0.1 or access to uncapped CPU
- Memory: >= 6 GB
- Disk: 200+GB. Can be internal or external disk.
- IBM i 7.1 or newer
- DS8K requires DSCLI installed on the IBM i
- IP connectivity to:

- o Source and Target LPARs
- o Storage (DS8K HMC or Storewize management interface
- o LPAR HMC
- The following LPP and PTFs:

7.1	7.2	7.3	7.4
5733SC1 *Base, 1	5733SC1 *Base, 1	5733SC1 *Base, 1	5733SC1 *Base, 1
5770SS1 30, 33, 41	5770SS1 30, 33, 41	5770SS1 30, 33, 41	5770SS1 30, 33, 41
5761JV1 *Base, 16	5770JV1 *Base, 16	5770JV1 *Base, 16	5770JV1 *Base, 16
5770HAS *Base, 1 or 2	5770HAS *Base, 1 or 2	5770HAS *Base, 1 or 2	5770HAS *Base, 1 or 2
Group PTFs SF99706, SF99572	Group PTFs SF99776, SF99716	Group PTFs SF99876, SF99725	Group PTFs SF99666, SF99665
5770HAS PTF SI57181	5770HAS PTF SI57302, SI62180		
	5770999 PTF MF62565	5770999 PTF MF62566	

NOTE: DS firmware levels 7.8.30.470 or greater requires Java 8 (5770JV1 opt 16) on the controlling LPAR. While the toolkit will work with Java 7, DSCLI will require Java 8, and therefore we recommend Java 8. For details installing Java 1.8 on IBM i please visit this page:

http://www-01.ibm.com/support/docview.wss?uid=nas8N1020692

Source LPAR Requirements

The Source LPAR must meet the following requirements:

- IBM i 7.1 or newer

- SYSBAS 100% on external storage
- Tape device connectivity
- The following PTFs:

7.1	7.2	7.3	7.4
MF99006, MF56047, SI49487	5770999 PTF MF62565, MF64640	5770999 PTF MF62566, MF64641	-None-
If using BRMS, the following PTF's are required (superceding PTF's are ok) :			
SI64249 (BR1) SI53781 (SS1)	SI70366 (BR1) SI53860 (SS1)	SI70367 (BR1)	SI70368 (BR1)

Target LPAR Requirements

The Target LPAR does not have any software requirements because it will have what is Flash Copied from the Source LPAR. However, it has these requirements:

- SYSBAS 100% on external storage, matching number and size of Source LPAR LUNs
- Tape device connectivity
- Enough CPU and Memory to run the backups
- Communication resources should not be in the same slots as those on the source LPAR
  - For example, if the source LPAR has a communications adapter in slot C2 then the target LPAR should not have a communications adapter in slot C2. In the event that the target LPAR is is IPL'd outside of the toolkit, or a line description for a source LPAR IP address is started inadvertently, it will not automatically use the resource in the expected slot.

Note that for Recovery Point Flash, no target LPAR is required.

Running FSFC jobs in another subsystem

FSFC jobs run in subsystems QZRDFSR and QSYSWRK. Any jobs submitted by the toolkit will use job description QZRDHASM/QLPARJOBD, which specifies job queue QSYSNOMAX. Modify that job description if the jobs must run elsewhere. Keep in mind that multiple threads/jobs may be needed to a single-threaded subsystem is inappropriate. Job description QLPARJOBD is created by SETUPFSFC.

Clustering Security Requirements

Note: Some of the TCP/IP servers used by clustering require that the QUSER user profile's STATUS = *ENABLED and that it does NOT have *SECADM or *ALLOBJ special authority. It must also NOT be expired. If this is not possible, the file /QIBM/ProdData/OS400/INETD/inetd.conf must be changed to use a different profile that matches these requirements.

```
Edit File: /QIBM/ProdData/OS400/INETD/inetd.conf
 Record :      10    of      20 by  10                       Column :     1     76 by 126
 Control :                                                                               .

CMD ....+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8..
    # ##### DO NOT MODIFY THIS FILE #####
    #
    # Any changes made to this file will be lost during release upgrade.
    # User-defined services may be defined in file:
    #   /QIBM/UserData/OS400/INETD/inetd.conf
    #
    #
    # Clustering
    as400-cluster  stream  tcp  wait    QUSER  /QSYS.LIB/QCSTINETD.PGM QCSTINETD
    #
     ************End of Data********************
```

Figure 0-1

The ALWADDCLU (Allow Add to Cluster) network attribute must be appropriately set on the node if trying to start a remote node. This should be set to *ANY or *RQSAUT depending on the environment. If set to *RQSAUT, then -- Digital Certificate Manager (57xxSS1 Option 34) on IBM i 6.1, or later release must be installed. This value can be changed back to **ALWADDCLU(*NONE)** after adding it to the cluster.

To change the ALWADDCLU (Allow Add to Cluster) network attribute, use the following green screen command:

> **CHGNETA (Change Network Attributes)**
> Specify **ALWADDCLU = *ANY** or ***RQSAUT**

Note: This applies only to the controlling nodes.

Requirement to coordinate QTIME between managing partitions

To prevent simultaneous operations on the same environment, a cluster wide lock per environment has been added, set at the start of SWPPRC, SWCSE, CHKPPRC, CHKCSE and STRFLASH etc. operations and released at the end. The default time for automatic release of the lock is 15 minutes, and the time-of-day for the timeout is calculated and communicated to the other nodes in the cluster. Therefore, it is preferable to make sure that the QTIME system value on all systems contain the same

time-of-day. You should consider use of the Simple Network Time Protocol (SNTP) TCP server to automate keeping the time synchronized.

Note: If systems are in different time zones or the system times are significantly different, then this locking will work only on the local system.

Setting up Full System Flash Copy

Considerations

At setup time, the source system will be running, and all resources required for that partition will be known to the system. However some information about FlashCopy target node resources may not be known until that node is activated for the first time. Some of this information can be inferred from LPAR number and resources. The IP addresses for both the source and target should be known prior to starting the setup.

The Controller partitions do not need to be dedicated to this purpose. They can be any other partition available, i.e., dev, QA, etc. They need to be able to communicate with the source and target partitions they will manage via TCP with the Full System Flash Copy tools. However, PowerHA Standard Edition is required, and is licensed according to the number of cores used. It may be more economical to create a small dedicated Controlling LPAR(s).

System name vs. LPAR name

The system name is stored in *SYSBAS via the CHGNETA command. Thus when the Target LPAR is active, it sees its system name as that of the Source LPAR. The LPAR name is stored in the hosting HMC, and is not modified during Flash Copy.

System serial number and software licensing

The serial number is stored in the hardware and if the Target LPAR is on a different system, the serial number will be different between the source and Target LPARs. Licenses for 3rd party software that depend upon a specific serial number will need to be adjusted after a switch. The new RTVLPARINF command can be used to determine the current LPAR for the system. The new RUNLPARCMD command can also be used in the startup program to make changes. Licenses for FSFC allow multiple serial numbers and will not require adjustment. You should check with the vendors of other licensed software to determine how to install serial-number-based licenses for their products.

The FSFC Toolkit requires a valid license for the controlling and Source LPARs. It does not check for a license on the Target LPAR.

IP addresses

The IP addresses and subnetwork of an LPAR may need to change as part of a switchover. The IP addresses and line descriptions for the Target LPAR must be configured on the Source LPAR so that after a Flash Copy, they are available to the Target LPAR. The FSFC Toolkit will control which line descriptions and IP addresses are activated on the source or Target LPARs. Prior to the Flash Copy, the line description, TCP and IP interfaces are changed to not start with the controlling subsystem; after the Flash Copy they are changed back to their original values. When the Target LPAR IPLs, the toolkit will only start the specified line description and IP interface. Route entries can also be changed.

Clustering

One or two Controlling LPAR(s)s are required in a cluster. The toolkit will function with a single controlling LPAR (i.e. a single node cluster). The cluster and device domain can have any names.

The cluster function allows the CSE data to be mirrored between the control nodes so that either control node can run functions at any time.

Source LPAR Communication Agent

The controller(s) must be able to communicate with the Source LPARs. To do so, subsystem QZRDFSR must be started on the source, controlling and Target LPARs, with pre-start program QZRDIAEXT2 handling service requests. The subsystem can be started by using command STRSBS /QZRDHASM/QZRDFSR . Use of the SETUPFSFC will stop and restart the subsystem. QZRDFSR

The Communication Agent listens on a specified port, and default port is 55920. On the Source LPAR, use the command SETUPFSFC to change the port. This information is stored in file /QIBM/Qzrdhasm/FSRPort. On the Controlling LPAR(s), the port is configured using CRTCSEDTA, CHGCSEDTA or WRKCSEDTA opt 2. The port specified must be the same on both the controller and Source LPAR.

FSFC and FSR use the same communication agent and port information. QZRDIAEXT2 is also used to receive QUSRBRM after a backup.

Communications between the source and Controller are encrypted.

Credentials

The Controller(s) must be able to communicate with all participants in the Full System Flash Copy environment:

1. Source Power System HMC
2. Target Power System HMC
3. Source SVC/DS HMC
4. Target SVC/DS HMC
5. Source node
6. Target node

Configuring the user profiles and passwords for the SVCs, DS HMCs and Power Systems HMCs in the configuration is required as part of setup.

LPAR date and time

The date and time of an LPAR is stored in the HMC with offsets stored in IBM i *SYSBAS. Since only *SYSBAS, not the HMC data, is replicated to the target site, the first time an LPAR is IPLed the date and time may need to be configured. Subsequent IPLs will retain the correct date/time.

Communications ports

The following communications ports are used by Full System Flash Copy Toolkit and access must be allowed through the firewall:

- Controlling partitions to SVC on port 22   (if applicable)

- Controlling partitions to DS HMC on ports 1751/1750 (if applicable)
- Controlling partition to Power Systems HMC on port 22
- All Controllers to source and Target LPARs on port 55920 (or the port you specify)
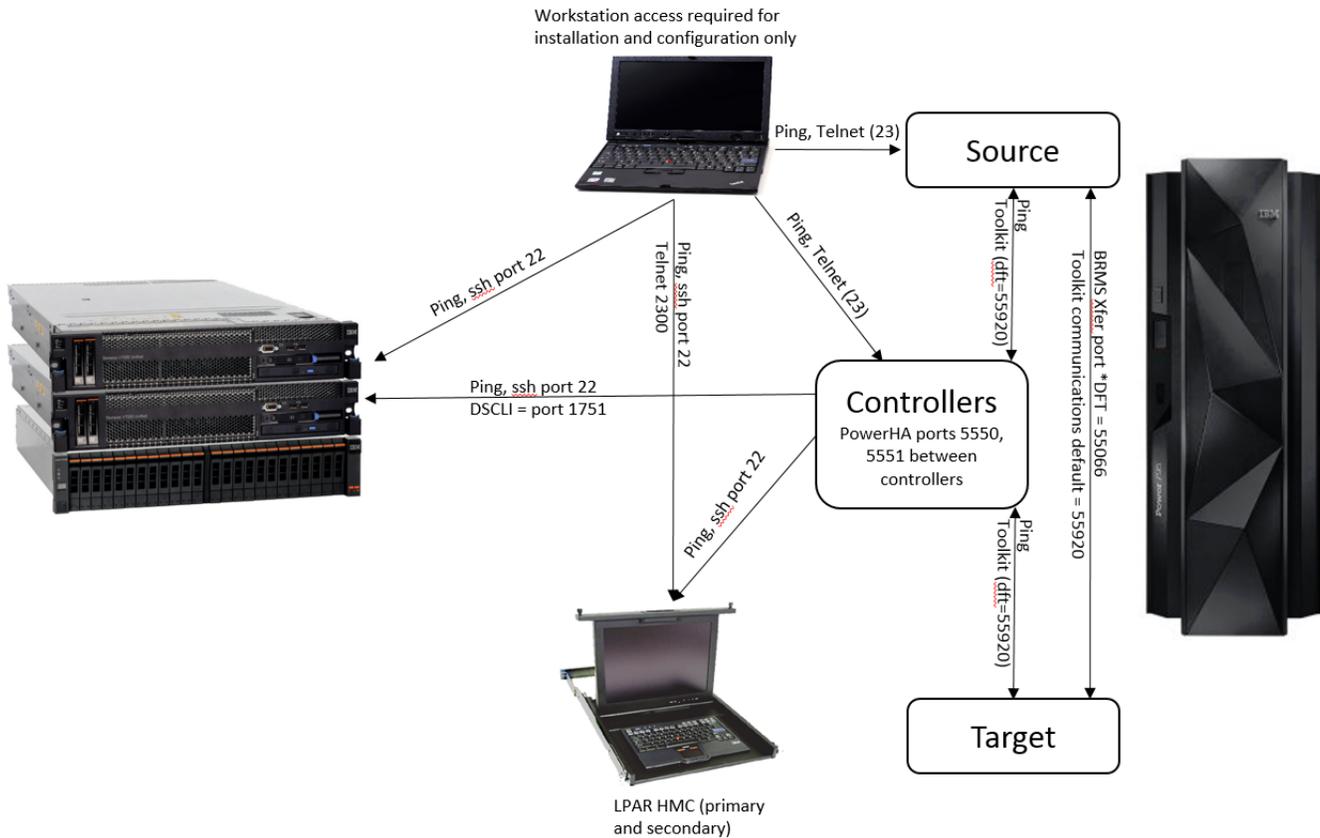
Remote FlashCopy

A FlashCopy operation between two LUNs can only occur in a single storage unit. The source LUNs can be the target of replication. The toolkit can manage the replication to a remote storage unit to facilitate FlashCopy there, in the following scenarios:

- Storwize using MMIR or GMCV
  - GMIR w/o change volumes is not supported
- DS8K using MMIR or GMIR
  - The toolkit will create use the D-Copy for FlashCopy purposes

For MMIR operations, there is no need to manage the replication. The toolkit Environments (WRKCSE) will use the remote storage as if it were the local one, because the MMIR target LUNs will always be synchronized with the source LUNs. Note that the FlashCopy toolkit will NOT monitor MMIR replication status; the Full System Replication Manager (a separate feature in the toolkit) can perform this function.

For DS8K GMIR operations, two Environments must be created, *with the same name*: a GMIR environment for managing the replication, and a FLASH environment with D-Copy LUNs enabled for

the Flashcopy operations. The toolkit will create the D-Copy using the GMIR 'pause with secondary access' function.

Storwize GMCV operations only requires one FLASH environment in WRKCSE which will contain the IP addresses of the local and remote storage units, as well as the Remote Copy Consistency Group ID's. The toolkit will monitor the freeze points of the GMCV replication and perform the Flashcopy at the correct time. The toolkit will tolerate a freeze time as much as two hours delayed, but a much smaller (< 10 minutes) delay is recommended.

Object Save Timestamps on Source LPAR are not Updated

The backups occur on the FlashCopy target LPAR which means the objects on the target will have their save timestamps updated. The source LPAR objects will NOT have their timestamps updated. These timestamps are important for two reasons:

Incremental Backups

Customers with Full System FlashCopy typically do not perform incremental backups. With the ability to allow for longer backup windows, most of our customers can now perform full backups every night, allowing for much simpler recovery processes.
However, there are still a handful of customers who choose to perform incremental backups on the target LPAR. The challenge is that the objects' save timestamps are not updated and SAVCHGOBJ will pick up all the changes since the previous full (*CUML) or incremental (*INCR) backup *on the source LPAR*. The best way to handle this is to use BRMS. When BRMS on the target LPAR runs, it will record all the reference timestamps for the objects into file QUSRBRM/QA1ALR and move that to the source LPAR. The next FlashCopy will copy that file to the target LPAR, and BRMS will use the information in that file as the changed object reference date.

Journal Receiver Management

Many products use the save timestamp of the journal receiver to manage when it is deleted. Since there is no API for the toolkit to update the save timestamp of a journal receiver, the customer must evaluate the best method of addressing their journal receiver management.
The most common method is to save the receivers on the production LPAR after the flashcopy backups have been completed.
Another method is to change the way the receivers are managed, i.e. delete them when they are no longer needed vs. when they are saved. Note that a receiver exit program can be used to block or delay the deletion.

Installation

Make the LPARs available

- Controlling LPARs -- create if necessary
- Source and target LPARs -- ensure there is an LPAR profile for the Target LPAR
- All Controlling LPAR(s)s and the Source LPARs must be active
- Target LPAR must be powered down but with resources identified.

Configure the External Storage Units
- Create the user profile and password.
  - For SVC, the user must have at minimum Copy Operator authority; if changing host connections then Administrator is needed
  - For DS8K the user should have admin authority
- Create the volumes and host connections
  - For Storwize:
    - Create flash copy consistency groups
    - Map the Target LUNs to the Target host
  - For DS8K:
    - Create the volume groups and host IO ports
    - Add the Target LUNs to the volume groups
    - Map the volume groups to the host connections
- If using replication or PPRC, configure that as well
  - Start replication early so the implementation will not have to wait

Implement any SAN zoning required
This task is usually not performed by IBM Systems Lab Services.

Install IBM PowerHA Standard Edition for i on the control nodes
A separate licensed program, **IBM PowerHA for i Standard Edition (5770HAS *BASE and Option 2),** is required. This provides the commands for configuring and starting clustering. If the controller is also used for Full System Replication, **IBM PowerHA for i Enterprise Edition (5770HAS *BASE and Option 1**) is required, and is sufficient for Flash Copy functions.

Set up and start clustering
There will be one or two control nodes in the cluster. Add the nodes to the device domain.

```
                         Display Cluster Information

Cluster  . . . . . . . . . . . . . :    <cluster name>
Consistent information in cluster  :    Yes
Number of cluster nodes  . . . . . :    2
Number of device domains . . . . . :    1


                         Cluster Membership List


Node         Status           ------Interface Addresses------
<PROD Ctl>   Active           nnn.nnn.nnn.nnn
<DR Ctl>     Active           nnn.nnn.nnn.nnn
```

For DS8K install DSCLI on the Controlling LPARs
The DSCLI CD is supplied with the DS8K and the ISO can be downloaded from Fix Central. Ensure you use the correct DSCLI to match the DS8K firmware level. Insert the CD or mount the ISO on a Windows/Apple/Linux workstation and start the installation to the Controlling LPARs.

Configure the HMCs

Using the Web Browser HMC GUI (classic or advanced) configure the following:

- Create a user profile with roles AllSystemResources and hmcsuperadmin
  - Can be any user name
- Enable Remote Command Execution
- Change the Network settings to allow ssh from the Controller (or all) IP addresses

Note: The user profile you created must be set to sign on in Classic mode. The HMC CLI is slightly different depending on whether the profile last signed on in the Classic or Enhanced GUI. The FSFC Toolkit uses the Classic HMC CLI.

Install FSFC on Controlling and Source LPARs

The FSFC Toolkit is delivered directly from IBM Systems Lab Services. You may already have received a copy of it prior to the engagement or the consultant may bring it with them. It is not available for download.

Perform this task on all Controller and Source LPARs.

- Restore library QZRDHASM from the savefile provided by the IBM Systems Lab Services consultant.
- Use the following command to restore the objects:
  - RSTLIB SAVLIB(QZRDHASM) DEV(*SAVF) SAVF(QZRDHASM43)
- If upgrading from an older copy of the toolkit, refer the chapter elsewhere in this document which discusses upgrades
- All the toolkit commands are in library QZRDHASM
  - ADDLIBLE QZRDHASM

Setup FSFC on Controlling LPARs

On the Controlling LPARs, use the command SETUPFSFC to:

- Identify the role of the LPAR (*CTL)
- Set the port number to be used for the QZRDFSR subsystem
  - *DFT = 55920
  - A port lower than 1024 is not recommended
- Install the Toolkit access code

```
                  Set up IBM Pwr HA tools - FSFC (SETUPFSFC)

 Type choices, press Enter.

 Node role . . . . . . . . . . .    *CTL            *CTL, *SRC
 FSFC communications port . . . .    *DFT            1-65535, *SAME, *DFT
 Toolkit access code . . . . . .    <enter your code here>
```

Controlling LPAR startup program changes

The controlling LPAR's startup program should be modified to include:
- STRCLUNOD for the local node
- STRSBS QZRDHASM/QZRDFSR

These two items should be executed after TCP has been started.

Since STRCLUNOD requires the *IOSYSCFG and QPGMR (which is the default profile which runs the startup program) doesn't have that, it is recommended to change the QSTRUPPGM job description to use profile QLPAR instead.

Setup FSFC on Source LPARs

On each Source LPAR, use the command SETUPFSFC to:

- Identify the role of the LPAR (*SRC)
- Set the port number to be used for the QZRDFSR subsystem
    - *DFT = 55920
    - A port lower than 1024 is not recommended
- Install the Toolkit access code
- Create the Line Description, IP Interface and Subnet mask
    - These items must exist on the Source LPAR and will be used on the Target LPAR after the Flash Copy
    - On the Source LPAR they will not have valid resources, and will not be configured to vary on or start automatically

```
                  Set up IBM Pwr HA tools - FSFC (SETUPFSFC)


 Type choices, press Enter.


 Node role  . . . . . . . . . . .    *SRC            *CTL, *SRC
 FSFC communications port . . . .    *DFT            1-65535, *SAME, *DFT
 Toolkit access code  . . . . . .    <enter your access code here>
 Create Target line description      FSFCLINE      *NONE, name
 Create Target TCP interface  . .    1.2.3.4
 Create Target TCP subnet mask  .    255.255.255.0
```

Source LPAR startup program changes

The source LPAR's startup program should be modified to include:
- QZRDHASM/RUNLPARCMD SRLN(xxxxxxx) LPAR(xx) CMD(CALL PGM(QZRDHASM/QZRDENDSBS))
    - Specify the target LPAR serial and LPAR numbers
    - Review QZRDHASM/QCLSRC QZRDENDSBS for changes
- STRSBS QZRDHASM/QZRDFSR

RUNLPARCMD should be placed at the very beginning of the startup program, before any other commands are called. The purpose of this is to prevent the customer startup program from being executed on the target LPAR and impersonating the production LPAR IP addresses and workload.

While the toolkit has other safeguards in place, this entry in the startup program is the "last line of defense" and guards against human as well as software errors.

License information

Although SETUPFSFC includes the Access Code field, ADDPRDACS and DSPPRDACS commands can also be used to add and display the license information for FSFC. ADDPRDACS can be used to enter keys for different serial numbers, and the FSFC Toolkit can determine which LPAR it is running on and check for the appropriate license.

Prior versions of the Toolkit did not require a license key on the target LPAR, but it does since 4.3. This is usually not a problem since the license key used for the source LPAR is valid for the target LPAR is the serial is not different. However, if the target LPAR serial is different from the source LPAR serial number a license key is required. Use ADDPRDACS on the source LPAR to enter the license key for use on the target LPAR, and specify the target LPAR serial number.

- ADDLIBLE QZRDHASM
- ADDPRDACS and press F4=Prompt

```
                    Add Product Access Code (ADDPRDACS)

 Type choices, press Enter.

 Access code  . . . . . . . . . .   _____
 System serial number . . . . . .   *CURRENT      Seven characters, no dash
```

The key is unique for each of the following:
- The system (serial number) on which FSFC is installed
- The Toolkit capabilities to be used (PPRC, Global Mirror, Full System Replication, Flash Copy)
- The Storage used (DS8K, SVC)

The license key enables use of the following commands for Full System Flash Copy:
- Work with CSE Credential List (WRKCSECRDL)
- Add CSE Credential Entry (ADDCSECRDE)
- Change CSE Credential Entry (CHGCSECRDE)
- Remove CSE Credential Entry (RMVCSECRDE)
- Work with CSE Environments (WRKCSE)
- Work with CSE Data (WRKCSEDTA)
- Change CSE Data (CHGCSEDTA)
- Create CSE CRG (CRTCSEDTA)
- Display CSE Data (DSPCSEDTA)
- Check FSFC Data (CHKFSFLASH)
- Start FSFC (STRFSFLASH)
- End FSFC (ENDFSFLASH)

- Retrieve LPAR Information (RTVLPARINF)
- Run LPAR Command (RUNLPARCMD)

Change ownership of FSFC objects

All FSFC objects are shipped as owned by QPGMR, and the *PUBLIC has *CHANGE authority to them. It is recommended to change the authorities to the objects in the QZRDHASM library based upon the security guidelines of your organization.

Download Java Secure Channel code (JSch)

Download JSch to /QIBM/qzrdhasm/ssh on all three nodes from
http://prdownloads.sourceforge.net/jsch/jsch-0.1.52.jar?download

- Don't download a different version. It won't work.
- The Java Secure Channel is an open-source implementation of ssh which allows FSFC to issue ssh calls programmatically and to review the results.
- Because it is open-source, you must download it yourself (i.e., we can't bundle it with our FSFC code). It is recommended to read the End User License Agreement for JSch.
- Download to your desktop and then use FTP to copy it to your IBM i at /QIBM/qzrdhasm/ssh.

The toolkit access the jar file via the symbolic link /QIBM/qzrdhasm/ssh/jsch.jar. If a different version is downloaded (for example 0.1.54) then change the symbolic link to use the newer jar version. Unless otherwise indicated, the toolkit is only tested with 0.1.52.

```
ftp> bin
200 Representation type is binary IMAGE
ftp> put jsch-0.1.52.jar /QIBM/qzrdhasm/ssh/jsch-0.1.52.jar
227 Entering Passive Mode (9,5,168,177,167,46).
150-NAMEFMT set to 1
150 Sending file to /QIBM/qzrdhasm/ssh/jsch-0.1.52.jar
226 File transfer completed successfully.
249282 bytes sent in 0.742 secs (336.12 Kbytes/sec)
ftp>
```

Create the credentials to be used by the control nodes

On either control node, use the Work with CSM Credentials List (WRKCSECRDL) command to enter the User IDs and passwords for:
- Storwize storage units
- DS8k storage units
- LPAR HMCs

The credentials information will be encrypted and replicated automatically to all nodes in the cluster.

```
                   Work with CSE Credentials List

 Type options, press Enter.
   1=Add    2=Change    4=Remove
```

```
Opt     Host IP Address     User ID             Host description
 _         nnn.nnn.nnn.nnn
```

Press Enter after keying the IP address to enable entry of the credentials for the device.

```
                    Add CSE Credential Entry (ADDCSECRDE)

Type choices, press Enter.

Host IP address . . . . . . . . > 'nnn.nnn.nnn.nnn'
User ID . . . . . . . . . . . .   _____
Password . . . . . . . . . . .
Confirm password . . . . . . .
Host description . . . . . . .    _____
```

Repeat for the other devices.

Create a Full System Flash Copy environment

Environments define the storage and can be used in multiple CSE Data's. There is a limit of 64 environments. This information will be replicated to the other control nodes.

Storwize Environments

Enter the WRKCSE command on either control node in the cluster.

```
                    Copy Services Environments

Type options, press Enter.
  1=Add   2=Change      4=Delete   5=Display       12=Work with
  14=List Stream files  16=Define host connections  18=Make PPRC Paths

Opt   Name        Type    Text
1     (name)                                                        .
```

Key the desired name and press Enter. You must then specify FLASH for Copy Service Type on the second display (GMIR if using Global Mirror with Change Volumes, GMCV).

```
                    Add an Environment

Enter Copy Service Type

Environment name . . . . :   (name)
Copy Service Type . . . .   FLASH           FLASH, GMIR, LUN, MMIR
```

And SVC for Storage Type on the third display.

```
                       Add an Environment

 Enter Copy Service Type


 Environment name . . . . :   (name)
 Copy Service Type  . . . :   FLASH
 Storage Type . . . . . . .   SVC                      DS8K, SVC
```

ASP/SVC Copy Descriptions are used by PowerHA for IASP operations. Full System FlashCopy does
not use Copy Descriptions, therefore you must specify *NONE for Preferred Source and Preferred
Target Copy Descriptions on the fourth display.

```
                       Add an Environment

 Enter Copy Services and ASP information


 Environment name . . . . :   (name)
 Copy Service Type  . . . :   FLASH
 Storage Type . . . . . . :   SVC

 ASP/SVC Copy Descriptions:
   Preferred Source . . . .   *NONE            Name, *NONE
   Preferred Target . . . .   *NONE            Name, *NONE
```

Enter the details for the SVC environment on the fifth display. Enter Storwize SVC IP address. The
toolkit will use the information in WRKCSECRDL to retrieve the user Id and password associated with
the specified IP address. If no credentials are stored for the specified IP address, you will be prompted
to "Press Enter or F12" to go to WRKCSECRDL or cancel.

Enter the FlashCopy consistency group Id.

If the FlashCopy is to be taken from the target of GMCV replication, enter the remote SVC IP address
and consistency group Id. If metro mirror replication is used, treat the remote SVC as a local SVC.
FlashCopy from a global mirror target is not supported.

```
                    Create a FLASH environment
 Type choices, press Enter.


 Environment name . . . . . . . . . :    (name)
 Storage Type . . . . . . . . . . . :    SVC

 FlashCopy SVC information:
   Flash SVC IP Address . . . . . . .   0.0.0.0              IPv4
   FlashCopy consistency group Id . .   0                    Id
   GMCV Source SVC IP Address . . . .                        IPv4
   Remote copy consistency group Id                          Id


 Comment:
   Text . . . . . . . . . . . . . . .
```

After entering all the data, press F6 to validate. This will use the stored credentials to log onto the SVC units and validate the consistency group exists.

DS8K Environments

If the intent is to perform the FlashCopy from a GMIR D-Copy, the GMIR environment must be created first. The GMIR and FLASH environments must have the same names.

Enter the WRKCSE command on either control node in the cluster. The information will be replicated to the other control node.

```
                         Copy Services Environments

 Type options, press Enter.
   1=Add   2=Change       4=Delete   5=Display        12=Work with
   14=List Stream files   16=Define host connections   18=Make PPRC Paths


 Opt   Name          Type    Text
 1_    (name)                                                         .
```

Key the desired name and press Enter. You must then specify FLASH for Copy Service Type on the second display.

```
                          Add an Environment

 Enter Copy Service Type

 Environment name . . . . :   (name)
 Copy Service Type  . . . .   FLASH_              FLASH, GMIR, LUN, MMIR
```

And DS8K for Storage Type on the third display.

```
                          Add an Environment

 Enter Copy Service Type

 Environment name . . . . :   (name)
 Copy Service Type  . . . :   FLASH
 Storage Type . . . . . . .   DS8K_                  DS8K, SVC
```

ASP/SVC Copy Descriptions are used by PowerHA for IASP operations. Full System FlashCopy does not use Copy Descriptions, therefore you must specify *NONE for Preferred Source and Preferred Target Copy Descriptions on the fourth display.

```
                      Add an Environment

              Enter Copy Services and ASP information

 Environment name . . . . :   (name)
 Copy Service Type  . . . :   FLASH
 Storage Type . . . . . . :   DS8K

 ASP/SVC Copy Descriptions:
   Preferred Source . . . .   *NONE                    Name, *NONE
   Preferred Target . . . .   *NONE                    Name, *NONE
```

Enter the details for the DS8K environment on the fifth display. Enter the DS unit information.

```
                    Create a FLASH environment
 Type choices, press Enter.


 Environment name . . . . . . . . . :   TEST
 Storage Type . . . . . . . . . . . :   DS8K

 FlashCopy Power HA, ASP information:
   Device name  . . . . . . . . . .   *SYSTEM        *SYSTEM, Name
   Source Copy Description  . . . . .   *NONE          *NONE, Name
   Target Copy Description  . . . . .   *NONE          *NONE, Name

 FlashCopy DS unit information:
   Device . . . . . . . . . . . . .   IBM.2705.xxxxxx  Name



                                                        More...
```

Page down for more parameters and set the options appropriately for the configuration.

Enter the Storage HMC (SMC) IP addresses. At least one is required.

The toolkit will use the information in WRKCSECRDL to retrieve the user Id and password associated with the specified IP addresses. If no credentials are stored for the specified IP address, you will be prompted to "Press Enter or F12" to go to WRKCSECRDL or cancel.

During the FlashCopy, if the toolkit receives an unexpected response from one storage HMC it will switch to the second one.

Specify the port number for DSCLI communications with the HMCs. 1751 is the default.

```
                    Create a FLASH environment
 Type choices, press Enter.


 FlashCopy Manager options:
   Full FlashCopy . . . . . . . . . .   *NO            *YES, *NO
   Resync FlashCopy . . . . . . . . .   *NO            *YES, *NO
```

```
   Multi incremental resync . . . . .    *YES                *YES, *NO
   Space Efficient FlashCopy  . . . .    *NO                 *YES, *NO
   Target PPRC  . . . . . . . . . .      *NO                 *YES, *NO
   GMIR D-Copy target flash . . . . .    *NO                 *YES, *NO

 DS unit SMC information:
   Flash hmc1 . . . . . . . . . . . .    1.2.3.4             IPv4
   Flash hmc2 . . . . . . . . . . . .    1.2.3.5             IPv4
   Port . . . . . . . . . . . . . . .    1751               1750, 1751

 Comment:
   Text . . . . . . . . . . . . . .
                                                             Bottom
```

Press enter, then key in the volumes for FlashCopy. If you select "GMIR D-Copy target flash" then
fields for additional volumes will be displayed.

```
                   Add, Change or Delete Volumes

   Environment  . :   (name)       Source device  :   IBM.2107-XXXXXX
   Type . . . . . :   FLASH        Target device  :   IBM.2107-XXXXXX
   Volume sets  . :   6

 Type Volume options; 1=Add, 2=Change, 4=Delete, press Enter.
           Source           Flash
   Opt     Volumes          Volumes

    _       _____         _____
    _       8810-8812        6810-6812
    _       8910-8912        6910-6912
```

Define Host Connections

The Full System Flash Copy Toolkit can manage the host connections in the storage unit. This is useful
if the target LPAR needs to connect to sets of LUNs. Each type of storage manages the host
connections differently.

*Note: Attempts to change vSCSI host connections may result in production LPAR outages and is
therefore not supported.*

Storwize Host Connections

Storwize host connections are managed by changing the mappings between the host and the LUNs. If
no host connection information is provided the mappings are not changed. If information is provided
then the following operations are performed prior to IPL'ing the target LPAR:

- The specified LUNs are unmapped from any hosts
- The specified hosts are unmapped from any LUNs
- The specified LUNs are mapped to the specified hosts

To specify the mappings, use the command WRKCSE and option 16 on the environment.

The mappings can be entered directly or F7 to import the hosts and volumes from the Storwize unit.

Press F4 again to prompt for a host name:

```
...............................................................................
:                              SVC Hosts                                     :
:                                                                             :
:  Type option, press Enter.                                                  :
:    1=Select                                                                 :
:                                                                             :
:  Opt      Host name                                                         :
:    _       ctciha9p_sys                                                     :
:    _       ctcvha9e                                                         :
:    _       ctciha4w                                                         :
:    _       ctciha4x                                                         :
:    _       ctciha4y                                                         :
:    _       ctciha4b                                                         :
:    _       ctciha4z                                                         :
:    _       ctciha9x_iasp02                                                  :
:                                                                More...   :
:  F1=Help   F12=Cancel                                                       :
:                                                                             :
:.............................................................................:
```

After selecting a host, select the volumes to map to that host:

```
                       Import SVC Volume Ids

SVC IP address . . . . :   9.5.167.149

Type host name or press F4 for choices.

Host . . . DEMO_FSCM_TGT

Type option, press Enter.
  1=Select

  Opt  Vol_Id  Volume name                    Disk pool           Capacity
    _        0  DEMO_FSCM_CTL3                 mdiskgrp0            50.00GB
    _        1  DEMO_FSCM_CTL4                 mdiskgrp0            50.00GB
    _        2  DEMO_FSCSM_SRC3                mdiskgrp0            50.00GB
    _        3  DEMO_FSCSM_SRC4                mdiskgrp0            50.00GB
    _        4  ha9v_7kgmir1                   mdiskgrp0            10.00GB
    _        5  ha9v_7kgmir2                   mdiskgrp0            10.00GB
    _        6  ctcvha9e_rootvg_1              mdiskgrp0           100.00GB
    _        7  HA9x_flash2_0                  mdiskgrp0            10.00GB
    _        8  HA9x_flash2_1                  mdiskgrp0            10.00GB
                                                                    More..
F1=Help    F3=Exit    F4=Prompt    F12=Cancel    F22=Display entire field
```

Then press enter

```
                       Define SVC Host Connections

  Environment  . . . . :   (name)          Type . . . . . . . . :    FLASH
  SVC IP address . . . :   (SVC Host IP address)
  Consistency group Id :   14

Type Host Connection option, press Enter.
  1=Add    2=Change   4=Remove   5=Display

       Volume
  Opt   range        Target host

   __    0060-0060   DEMO_FSCM_TGT
   __    0067-0070   DEMO_FSCM_TGT


                                                                     Bottom
F1=Help   F3=Exit       F4=Prompt   F5=Refresh   F6=Validate
F7=Import volume ids    F12=Cancel
**WARNING Changing vSCSI host connections may cause production LPAR outages.
```

After entering the host connection information, press F6 to validate them. This will log into the Storwize unit with the stored credentials and verify the hosts and volumes exist.

DS8K Host Connections

DS8K host connections are also managed using WRKCSE opt 16, but uses volume groups instead of volumes, and IO ports instead of hosts.

```
                       Define Host Connections

  Environment  . :   FSFCDS8K               Device . . . . :
  Type . . . . . :   FLASH

 Type Host Connection options; 1=Add, 2=Change, 4=Delete, press Enter.

           Volume         Host
  Opt      Group          Connection ID

   __      ____           ____
   __       V27            0020

```

Use the DSCLI commands *lsvolgrp* and *lsioport* to get the information required. Note that multiple IO ports can be mapped to the same volume group.

The information entered is used to create the scripts for adding and dropping host connections (WRKCSE opt 14). If these exist, the toolkit will apply these scripts prior to IPL'ing the target partition.

Create Copy Services Environment (CSE) Data

Use the CRTCSEDTA command on either control node in the cluster to enter the node information, including details specifying how to flush memory, the backups commands, IP addresses etc. The command CRTCSEDTA is described in detail elsewhere in this guide. The CSE Data defines how the FlashCopy is to occur, which backup commands to execute, etc. The information entered is stored in a Data CRG which can be viewed/removed from WRKCLU opt 9. Note that the Data CRG will remain inactive.

The first CSE Data you create will be only for the purpose of testing the configuration, therefore we do not want to impact users, enter backup commands etc. Select a name for the CSE Data which reflects that. Follow these guidelines when creating your for CSE Data:

- Temporary name:
  We will later create a copy which has a permanent name
- Memory flush: *FRCWRT
- No BRMS integration
- Enter the device and comm adapter information and IP addresses if you have it
- No backup commands
- Wait for ENDSYSCPY set to *NO
- Target keylock position should be *MANUAL

Check the configuration details (CHKFSFLASH)

Issue the command CHKFSFLASH with the CSE Data you just created. This command will check all the communications paths etc. If the command fails, use the joblog and toolkit logs to determine the problem.

Perform the flashcopy (STRFSFLASH)

Before issuing the STRFSFLASH command, sign on to the source LPAR. Prompt on CHGIPLA and record the current setting for starting in restricted state (STRRSTD). Change it to *YES if it isn't already set to it. We will only do this the first time, to allow us to verify the LPAR is properly Flash Copied.

On the controlling LPAR, use the command STRFSFLASH to start the flashcopy. This command will perform many of the checks performed by CHKFSFLASH, then it will continue with the memory flush, flashcopy, and IPL of the target LPAR.

Once the target LPAR has started to IPL, use CHGIPLA to change the STRRSTD back to its original value.

Monitor the target LPAR

The target LPAR is to start in manual mode. Connect to the console, wait for it to reach the DST panel, and continue the IPL. Set the date/time when prompted (this only needs to be done once), and continue the IPL.

When you are prompted to set major options, verify it is set to not start TCP, and that it will start to restricted state. Continue the IPL.

When the command line appears, issue the command DSPSYSVAL QSTRUPPGM. Verify the startup program is set to QZRDHASM/QZRDIASTRP. This is the startup program for the toolkit, and it indicates the memory was properly flushed, the correct LUNs were Flash Copied, and the target LPAR is attached to the correct Flash Copy LUNs.

If the user's startup program (i.e. QSYS/QSTRUP or something similar) is listed, STOP IMMEDIATELY and do not start the controlling LPAR. Verify the correct LUNs are attached, the correct consistency group, and the flashcopy mappings are used. Resolve the issues, terminate the STRFSFLASH, and try again.

If the correct startup program (QZRDIASTRP) is listed, then start the controlling subsystem.

If a device and comm details were specified, verify they are correctly configured. It not, gather the information you need from WRKHDWRSC *CMN/*STG to finish the configuration, and continue the operation until STRFSFLASH (on the controller) finishes.

Create CSE Data to perform a backup

Please see the section *Backups with BRMS* if it is relevant, and implement what is required on the source LPAR before proceeding.

On the controlling LPAR, use the command CPYCSEDTA or WRKCSEDTA opt 3 to create a new CSE Data based on the the bare-bones configuration you've just created. However, this time:

- Real name:
  This is the name of the CSE Data you'll be using, and should reflect the source LPAR and type of backup (full/daily) it will be doing.
- Memory flush: *QUIESCE or *FRCWRT
  *QUIESCE is better if the users and application can tolerate
- Appropriate BRMS integration
- Enter the device and comm adapter information and IP addresses
- Specify a backup command
- Wait for ENDSYSCPY set to *YES
- Target keylock position should be *AUTO

Check the configuration details (CHKFSFLASH)

Issue the command CHKFSFLASH with the CSE Data you just created. This command will check all the communications paths etc. If the command fails, use the joblog and toolkit logs to determine the problem.

Perform the flashcopy (STRFSFLASH)

On the controlling LPAR, use the command STRFSFLASH to start the flashcopy. This command will perform many of the checks performed by CHKFSFLASH, then it will continue with the memory flush, flashcopy, and IPL of the target LPAR.

Monitor the target LPAR

The target LPAR will IPL, configure the tape and communications devices and then start the backups. If the backups are in restricted state, the console will go away for the duration and the SRC reference code will be A900370C. After the backups are finished, if the BRMS integration was specified, BRMS will be transferred to the source LPAR. At the end of the process the log files will be sent from the source and target LPARs to the controlling LPAR.

Create additional CSE Data's for other backups and LPARs

Once you've perfected the Flash Copy process such that STRFSFLASH runs satisfactorily, create more CSE Data's using the CPYCSEDTA command to run different types of backups. The STRFSFLASH command be placed on the job scheduler, called from another application, or issued from the production LPAR. Integrating it with a customer's environment may require additional testing.

Backups

The Full System Flash Copy Toolkit is designed to automate the process to create a point-in-time clone of a production LPAR for the purposes of backups. While it has provisions to start backups, it is not a backup application and it is the responsibility of the customer to manage and monitor their backups.

Backups with BRMS

Overview

Performing a Flash Copy of a partition creates an identical copy of the partition, and that includes BRMS. If the BRMS processes are not followed, there will be two BRMS systems with identical names in the BRMS network group, with the result being a loss of integrity when the BRMS data is synchronized to one or more partitions. In order to manage this correctly, there must only be one unique active instance of a BRMS partition in a BRMS network group. BRMS has documented program calls to activate and deactivate partitions to maintain the integrity of the BRMS network group.

Consider the BRMS network group which consists of partitions SYSA, SYSB and SYSC. If a Flash Copy is performed on SYSA, there will be two active BRMS partitions named SYSA. In order to prevent this, we will deactivate BRMS on SYSA prior to the Flash Copy. After the Flash Copy is complete, we will activate BRMS on only one of the two instances of BRMS. The backups should be performed on the active BRMS partition. Backups can be performed on the inactive BRMS partition, but the information generated from the backups on the inactive BRMS partition will not be shared with the BRMS network group, and will be overwritten when QUSRBRM is copied back from the target partition. Restores can be performed on both inactive and active BRMS partitions since it does not change any BRMS information. After the backups have finished, and you wish to switch which partition has BRMS active, both partitions will be deactivated, the current data (library QUSRBRM) will be moved from where the backups were performed to the other partition, and BRMS on that partition will be activated. Following these procedures will maintain the integrity of the BRMS database.

The Flash Copy Toolkit has the ability to extract only changed BRMS media, save history and object detail from the target LPAR and insert it into the source LPAR's BRMS database. To enable this feature use the CRTCSEDTA/CHGCSEDTA parameter *BRMS Transfer method* (*CHGONLY). When using this, it is recommended that each target LPAR have a dedicated BRMS media class to select from.

The Flash Copy Toolki also has the ability to restrict the use of BRMS media classes on the source and target LPAR's. This is necessary to prevent the LPAR's from using media from the same media class during simultaneous operations, as BRMS on each LPAR is not able to communicate with the other LPAR. To enable this feature use the CRTCSEDTA/CHGCSEDTA parameter *Restricted media class(es).* This will use the Functional Authority to manage access to the specified media classes when BRMS is vulnerable to overwriting media.

BRMS Network Feature

If BRMS is the configured backup application, the Full System Flash Copy Toolkit will integrate with it to ensure that the BRMS database is kept intact and updated from the target LPAR. BRMS requires that the Networking Feature be installed and licensed on the controlling LPAR to use Flash Copy. However, the purpose of the Flash Copy function is to protect the BRMS database when it is participating in a BRMS Network Group; if the LPAR is not in a Network Group and does not have Network Feature installed, the Flash Copy Toolkit will not change the BRMS Flash Copy states.

Moving QUSRBRM

After the backups have been performed on the target partition, media, history, and object level detail must be moved from the target to the source partition. This information is stored in the library QUSRBRM and is illustrated by performing WRKMEDIBRM on both partitions after the backups have finished but before QUSRBRM has been moved. On the target partition, the command will display your new backup history. On the source partition there will be no record of the backup, even if the source partition is receiving media information, because incoming networking operations have been blocked. To keep this new information, QUSRBRM must be moved from the target partition to the source partition before the source partition is activated.

Note that QUSRBRM can be a large library and must be moved in its entirety. This move can take a while. To minimize the amount of data to transfer, and thus the time required to transfer QUSRBRM, consider reducing the amount of object detail retained and not receiving saved history information from other systems. If BRMS is not the specified backup application, this step will be not be performed. Specifying the data compression for the save of QUSRBRM will only apply saving QUSRBRM to the virtual tape; *MEDIUM is usually the best compromise between time spent on compression vs. how much smaller the virtual tape file is. QUSRBRM is easily compressed to nearly one tenth of its size, so it is highly recommended that compression be tried. Ultimately, the effectiveness of the compression is going to depend on CPU and network resources.

Prior to version 4.3 QUSRBRM was saved to a savefile and then groups of records from the savefile were sent to the source LPAR. At version 4.3 virtual tape is used. The change to use the IFS dramatically reduced the time it took to transfer the data. The data is encrypted during the transfer.

The default method to move BRMS is *ALL, i.e. the entire library is sent from the target to the source partitions, and in most cases this is preferred. If the customer must retain access to the BRMS library on the source LPAR or is using Multi-Flash, then *CHGONLY must be used.

*Partial Changes Only (*CHGONLY)*

*CHGONLY only moves the new and changed records from the target LPAR to the source LPAR. The toolkit will only move the new records related to the media, history information, object detail, reference date/time, and log entries.. Changes to other BRMS artifacts such as control groups or system policies will not be brought back to the source LPAR. While this method will dramatically reduce the amount of data to transfer over the network, there is a time penalty for extracting that information on the target LPAR and then inserting it into the source LPAR. Whether this method is faster than bringing all of

QUSRBRM back depends on many factors, such as the size of QUSRBRM, how much object detail is generated, CPW, disk arms and network speed.

The merge of records will be performed in two steps. First the save and object detail records for the media used will be removed from the BRMS files. Then media inventory and save history will be moved and BRMS will be unlocked and the merge exit program will be called with the "*MERGE1" option. The next step is to clean out old history from the volumes merged, then the exit program is called with '*MERGE2'. Finally, the object detail will be merged and the exit program will be called with the "*MERGE3" parameter and the process will be finished.

A benefit of using this method is that BRMS can be active on both LPAR's. In other words, you can perform backups on both the target and source LPAR at the same time, with the changes being merged back with the source LPAR. However, to avoid media collisions, it is HIGHLY recommended that each target LPAR have its own media class to select media from, since it will not be able to communicate with other LPAR's during the backup. See the RSTDMEDCLS parameter on CRTCSEDTA and CHGCSEDTA to restrict and allow specific media classes, and LOCKBRMS to block other BRMS activities. Use the STRBALBRM command to balance media across multiple LPARs and media classes.

Incremental Backups

With BRMS you can perform incremental (*INCR and *CUML) backups with Flash Copy. However, most Full System Flash Copy customers choose not to. The reason most non-Flash Copy customers perform incremental backups is to reduce the amount of time it takes to perform the backup. Since the Flash Copy technology removes the impact to the users, most Flash Copy customers will perform full backups instead, and that is our recommendation. Not only does it result in a more complete backup, but it also significantly reduces the complexity of restoring data, as only one restore is necessary vs. one full and then subsequent incrementals.

Each i5/OS object has internal information including when it was last saved. This information is used by SAVCHGOBJ to determine whether to save it again. When you perform a Flash Copy, that data is copied from the source LPAR to the target LPAR. However, that information is not moved back to the source LPAR after backups on the target LPAR, therefore native SAVCHGOBJ on the source LPAR will not be effective. However, BRMS retains a record of the full save, and thus BRMS will build the commands using the REFDATE and REFTIME parameters, with information from the BRMS files. These parameters will default to the actual backup date and time on the target LPAR; to truly reflect the object changes, it should be based on the Flash Copy timestamp. The Toolkit creates data area QZRDHASM/QZRFLSHTME on the source LPAR immediately before flushing memory and it contains the timestamp of the Flash Copy. This data area is then available on the target LPAR for use. BRMS does have a "customer timestamp" feature which can change the backup time, however it is only supported for saving objects in an IASP, not in *SYSBAS.
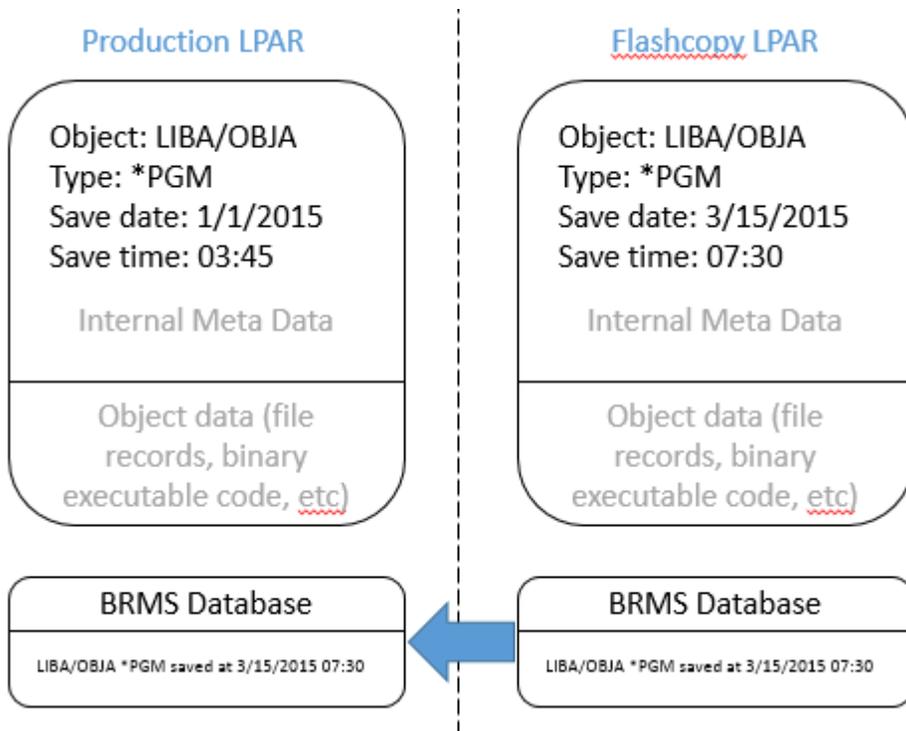
Note that in order to effectively perform incremental backups in BRMS, object detail must be saved.

Media Device Configuration

A side effect of performing Flash Copies with BRMS is that the device configurations on the paired partitions may not be identical. This poses a difficulty within BRMS because BRMS will retrieve the device capabilities when associating devices to densities in control groups and system policies. If the densities cannot be retrieved, BRMS cannot verify compatibility with the devices and will not allow you to change them.

In most environments both the source and target partitions are attached to the same tape devices, which allows configuring BRMS to use those devices on the source LPAR. When the LPAR is Flash Copied, the IPL process may identify the tape device attached to the target LPAR as a new device, and then auto-configure a new resource name and device description. BRMS is not aware of these devices, and rather than change the BRMS device tables and control groups, the Toolkit has the ability to identify the resource name based on the desired serial number, and then change the specified device description to use the new resource name. This configuration is performed in CRTCSEDTA and CHGCSEDTA. Please refer to those commands elsewhere in this document for more details.

The easiest method to configure BRMS when the source partition will not normally have a device attached is to temporarily attach a device and then perform the necessary configurations. Another option is to perform a test Flash Copy, configure BRMS on the target partition with the device, and then copy the entire QUSRBRM library back to the source partition.

A less common but equally valid configuration is where the source and target LPARs are at different sites and attached to different devices. In BRMS, this will be reflected as two different locations. The source LPAR must still know about the remote location's inventory so that the target LPAR has this information after a Flash Copy. The best way to implement this is to have a controlling LPAR at the remote site attached to the device, and which is also in a BRMS Network Group with the source LPAR. When the controlling LPAR performs media maintenance (ADDMLMBRM, MOVMEDBRM etc) the BRMS Network will ensure that the inventory awareness is shared with the source LPAR. It may be beneficial to use CHGBRMSOBJ and RUNLPARCMD to modify which location a device is associated with, based on which serial number it is currently running on.

Restricted State TCP/IP

BRMS has the ability to start a restricted state TCP/IP interface to communicate with other BRMS partitions. The Flash Copy Toolkit will automatically configure this if the BRMS integration is enabled and a TCP/IP interface is specified on the *IP Interface* parameter.

On the target partition, the Flash Copy Toolkit will remove all restricted state TCP/IP interfaces and add the interfaces specified on the *IP Interface* parameter. These values will not be moved back to the source partition. After QUSRBRM is moved to the source partition, the original restricted state TCP/IP interfaces on the source partition will remain unchanged.

Locking the QUSRBRM Library

If the Flash Copy Toolkit is configured to bring back the entire QUSRBRM library, access to it should be locked. After the backups have been performed on the target partition the QUSRBRM library will be moved to the source partition, overwriting any BRMS changes there. To prevent inadvertently performing backups, maintenance or other procedures which will change BRMS, and then be lost, use the *Lock BRMS* and *Lock type* parameters on the CRTCSEDTA and CHGCSEDTA commands. This will cause the Flash Copy Toolkit to first save the current BRMS Functional Usage settings, then modify the following Functional Usage areas to prevent changing BRMS:

- QIBM_Q1A_ARC
- QIBM_Q1A_ARC_PCY
- QIBM_Q1A_BKU
- QIBM_Q1A_BKU_PCY
- QIBM_Q1A_MED
- QIBM_Q1A_MED_ADV
- QIBM_Q1A_MED_INF
- QIBM_Q1A_MGR
- QIBM_Q1A_MGR_ADV
- QIBM_Q1A_MGR_PCY
- QIBM_Q1A_MOV
- QIBM_Q1A_MOV_VFY
- QIBM_Q1A_INZBRM
- QIBM_Q1A_SYS

- QIBM_Q1A_SYS_ASP
- QIBM_Q1A_SYS_PCY
- QIBM_Q1A_SYS_MNT
- QIBM_Q1A_SYS_DEV

This will take effect on the source partition until QUSRBRM has been moved. If specified, the restrictions will be implemented on the target partition after QUSRBRM has been moved.
The Flash Copy Toolkit also has the option to use the BRMS "STOPJOBS" mechanism to prevent BRMS jobs from from running.

If the process fails and you need to restore the original Functional Usage settings, issue the following command:

ENDFSFLASH *RSTFCNUSG

If the user space is found, it will restore from it.

Restricting BRMS by Media Class

The toolkit has the ability to restrict backup activity by media class. On the CRTCSEDTA and CHGCSEDTA commands there is a *Restricted media class(es)* parameter. Media classes entered here will behave in the following manner:

- Before FlashCopy:
  No Restrictions.
- During backups on target:
  Source: Cannot use restricted media classes.
  Target: Can only use restricted media classes.
- After backups on target:
  Source: No restrictions.
  Target: All media classes restricted.

The toolkit uses a combination of Functional Usage and the Tape management exit program to achieve this functionality.

Control Group Modifications

If the backup commands specified on the CRTCSEDTA and CHGCSEDTA commands are asynchronous, i.e. they submit backup commands to other jobs and return control back to the caller before the backups are finished, the controlling partition needs to be notified when the backups have finished. By default, STRBKUBRM will submit the backup to batch, and control will return to the caller immediately. In order to notify the controller that it must wait for a notification that the backups have finished, specify *Wait for ENDFSFLASH *YES* on the CRTCSEDTA and CHGCSEDTA commands, and issue QZRDHASM/ENDFSFLASH on the target partition after the backups have finished, for example as the last exit of the control group (which is called after any subsystems have been started) . On the source LPAR, QZRDIAEXT2 will block until it has reached the controlling

partition. When the controlling partition receives the ENDBACKUPS notification from ENDFSFLASH, it will initiate moving QUSRBRM from the target partition to the source LPAR.

If your backup commands are synchronous, i.e. SAVLIBBRM or STRBKUBRM SBMJOB(*NO) then specify *Wait for ENDFSFLASH* *NO on the CRTCSEDTA and CHGCSEDTA commands and the controlling partition will proceed to move QUSRBRM immediately after the backup commands have returned control, instead of waiting for ENDFSFLASH.

System Policy

If your backup strategy involves SAVSYS which requires operating in restricted state, change the BRMS system policy to allow backups to run in restricted state. To do so, issue WRKSYSPCY *SYS, then option 1, and page down to see the "Controlling subsystem: Allow backups in batch" parameter and change it to *YES. Consider whether it is necessary to specify a maximum time to remain in restricted state, in case your backups fail and BRMS fails to restart the subsystems. Most customers use *NOMAX.

Duplication and Maintenance

It is not uncommon to perform duplications (DUPMEDBRM) and maintenance (STRMNTBRM) after the backup. This can be performed on either the source partition after QUSRBRM has been moved, or on the target partition before QUSRBRM has been moved.

You may choose to perform these operations on the target partition to minimize CPU, disk arm, I/O and device contention on the source system. However, it will keep BRMS locked on the source longer, therefore our recommendation is to perform these tasks on the source LPAR after the process has finished.

Many customers choose to place these tasks on the source LPAR job scheduler. It is crucial that these jobs start *after* the Flash Copy process has finished. An alternative which has worked well for many of our customers is to use the Toolkit Exit Program to launch post-backup tasks on the source LPAR. That ensures that maintenance and duplication is performed immediately after the BRMS data has been copied back.

Recoveries and Reports

The Toolkit makes as few changes as necessary to the target LPAR prior to the backups running, with the intent to keep the backup of the target LPAR as similar as a backup on the source LPAR would have been. However, there are some key changes performed to minimize the chance that the target LPAR can come online with the source LPAR IP addresses, running applications etc. These changes include:

- System value for startup program (QSTRUPPGM) is set to *NONE to prevent the customer's program from running when BRMS leave restricted state, if a user starts QCTL, or if the LPAR is IPL'd
- CHGIPLA STRTCP is set to *NO to prevent TCP from starting if the system is IPL'd

- Line descriptions are set to not vary on at IPL
- Removes the autostart job entry for the BRMS system start detection (QBRMSTRUP)
- Optionally holds all basic job scheduler entries
- Additional customizations

Based on the above, if a recovery from a Flash Copy backup is performed, these items must be changed back to the original values after the configuration is restored (RSTCFG). To assist recovery efforts, it is recommended to add these steps to the BRMS recovery reports. To do so, on the source LPAR edit the members in QUSRBRM/QO1AUSRRCY. Each member (STEP001 etc) corresponds to the step in the recovery report and any text in that member will be inserted at that step. Note that the steps are relative and may change at different releases; it is suggested that you view a complete recovery report from your system to determine the correct step for RSTCFG. Typically that is at Step 14 up to V7R2, and Step 19 thereafter.

Here is an example of a report with the custom user-recovery steps:

```
__ STEP 011 : Recover Configuration Data
   Start date/time _____    Stop date/time _____
        You should restore a current version of your system configuration.
        If the "Select Recovery Items" display is not shown and you are
        performing a complete system restore, run the following command.
            STRRCYBRM OPTION(*RESUME)
        Otherwise, run the following command.
            STRRCYBRM OPTION(*SYSBAS) ACTION(*RESTORE)
      Type the command choice and press "Enter".
      Select the saved item(s) listed below from the "Select Recovery Items"
      display and press "Enter" to recover these saved items. Recovery of
      these saved items will require the volumes listed on the report or
      duplicate volumes.
      -----  User Recovery Information  ----------------------------------------
      CHGSYSVAL SYSVAL(QSTRUPPGM) VALUE('QSTRUP    QSYS      ')
      CHGLINETH LIND(ETHLINE) ONLINE(*YES)
      CHGTCPIFC INTNETADR('1.2.3.4') AUTOSTART(*YES)
      CHGIPLA STRTCP(*YES)
      Release the following jobs on the scheduler:
      - one
      - two
      - three
      -------------------------------------------------------------------------
                                               --- Objects ---
   Saved        Save     ----- ASP ------  Save    Save          Not   Sequence
   Item         Type     Name    Number  Date     Time    Saved  Saved Number
   ----------  -------  ---------- ----- -------- -------- -------- ------ --------- -------
__  *SAVCFG     *FULL    *SYSBAS   00001  8/17/17 23:01:21    319     0    25361
```

The BRMS maintenance command STRMNTBRM can create recovery reports, but they will not contain the customized user recovery steps. Only STRRCYBRM USRRCYINF(*ADD) will generate those reports. Our recommendation is to omit the reports from STRMNTRBM using the

PRTRCYRPT(*NONE) parameter, and then issue the STRRCYBRM immediately after STRMNTBRM finishes.

BRMS Backup Logs

When using BRMS transfer method *ALL, the toolkit will bring back the entire QUSRBRM library. If you want to bring back the backup joblogs, place them in library QUSRBRM.

Recovery Point FlashCopy

A **Recovery Point FlashCopy** (RPF) differs from a standard Full System FlashCopy (FSFC) in that the purpose of the FlashCopy isn't to create a backup, but rather to create a point in time copy which can easily be recovered from. System values, line descriptions etc are not changed prior the FlashCopy.

Note: Recovery Point FlashCopy is only supported for Storwize products. It is <u>not</u> the same as DS8K SafeGuarded Copies.

The methods to flush memory remain the same as FSFC: *FRCWRT, *QUIESCE and *IPL. There are no BRMS integrations and no target LPAR communications resources to manage. There should be no target LPAR or host connections attached to the target LUNs. It is currently only supported for Storwize storage devices.

The intent is that customers will schedule the FlashCopy to occur on a periodic basis, perhaps every couple hours, to thin-provisioned LUNs. Fully provisioned LUNs can also be used. There may be a performance penalty to the source LPAR while data (changed and unchanged) is copied to the RPF LUNs.

When configured to perform multiple Flashcopies from a single source LUN, internally the Storwize implements it as a cascaded copy, thus one host write may result in one write per Flashcopy, tripling or quadrupling the Storwize workload.

Note: The Storwize should be properly sized and designed to handle the additional workload. The performance penalty to all the disk I/O on the Storwize may be significant enough to take hosts offline. If more than one RPF per production LPAR is desired, strong consideration should be given to implement DS8K SafeGuarded Copies instead.

To use RPF, follow these steps:

- WRKCSE opt 1 to create an SVC FlashCopy Environment
  - Use Opt 16 to define the host connections from the production host to the RPF LUNs.
- Create environment variable QZRDHASM_RECOVERY_POINT
- WRKCSEDTA opt 1 to create a *SYSTEM SVC FlashCopy CSE Data. Note the "Recovery Point Flash" parameter. Enter *YES and press <ENTER>
- Provide the remaining information

- Use CHKFSFLASH to assess whether a FlashCopy is possible
- Use STRFSFLASH to create the FlashCopy
  - Place the STRFSFLASH on the job scheduler to create a RPF on a periodic basis or issue the command prior to large changes you may want to back out (i.e. upgrades or batch processing)
- The command CHKRCYPNT can be used to check that there is a FlashCopy available to recover from. It will list the timestamp of the FlashCopy
- In the event a recovery is required, used the command SWRCYPNT. This will shut down the production LPAR, change host connections to attach it to the target LUNs, modify the copy rate, and IPL.

Switching the production LPAR back to the original LUNs is a manual process. If the goal to revert to the original LUNs and discard changes to the RPF LUNs:

1. Shut down the LPAR
2. Change the host connections to the original LUNs
3. IPL the LPAR.

If there is a need to retain the changes made to the RPF LUNs:

1. Create a reverse-flash consistency group
   a. Ensure that the copy and cleaning rates are greater than 1
   b. Specify 'Delete wrapping after completion'
2. Shut down the LPAR
3. If the original LUNs are in a remote copy relationship, end the replication
4. Start the reverse-flash consistency group
5. Change host connections
6. IPL the LPAR
7. When the reverse-flash consistency group when it reaches 100% copied the mappings will be removed
8. Restart replication from the source LUNs if necessary.

Commands

ADDCSECRDE - Add CSE Credential Entry

ADDCSECRDE allows the user to add credential entries. This information is used by the toolkit whenever it needs to communicate with the device specified on the Host IP address parameter, and is used when communicating with the DS8K, HMC and SVC's. This information is encrypted and stored in the PowerHA device data domain, and is available to all the nodes in the cluster.

```
                    Add CSE Credential Entry (ADDCSECRDE)
```

```
Type choices, press Enter.

Host IP address  . . . . . . . .  _____
User ID  . . . . . . . . . . .    _____
Password . . . . . . . . . . .
Confirm password . . . . . . . .
Host description . . . . . . . .  _____
```

Host IP address: Enter the IP address of the host which the credentials are for. A valid IP address is required; name resolution is not performed by the toolkit.

User ID: Enter the user ID which exists on the device specified by the Host IP address.

Password: Enter the password for the user ID which exists on the device specified by the Host IP address.

Confirm password: Re-enter the password to ensure that it is correct.

Host description: Enter a description to make it easy for humans to see which host the IP address is for.

CHGBLDFLG – Change Build Flags

This command alters flags held in the BUILD data area that are used for debugging and other purposes within PowerHA Toolkit for IBM i. The command should only be used when so recommended by an IBM consultant or support personnel.

```
                 Change ICSM Build Flag (CHGBLDFLG)

 Type choices, press Enter.

 Specific build flag  . . . . . .   *DEBUGEXIT    *DEBUGEXIT, *DEBUGFLASH...
 Setting  . . . . . . . . . . .     *OFF          *ON, *OFF
```

Specific build flag: Determines which flag to toggle. The possible values are:

- ***DEBUGCRG:** Change the DEBUGCRG flag used with the toolkit. Setting it on will result in more detailed messages related to the CRG DDD space.

- ***DEBUGEXIT**: Change the DEBUGEXIT flag used with the toolkit for debugging the CRG exit program.

- ***DEBUGFLASH:** Change the DEBUGFLASH flag used with the toolkit. Setting it on will result in more detailed messages related to flash operations.

- ***DEBUGTPC:** Change the DEBUGTPC flag used within the toolkit for debugging CSM (formerly TPC-R).

- ***DEBUGDDD:** Change the DEBUGDDD flag used within the toolkit. Setting it on will result in more detailed messages related to the DDD space.

- ***TEST:** Change the TEST flag used within the toolkit. This should only be used for toolkit development testing.

- ***XTRALOGS:** Change the XTRALOGS flag used within the toolkit. This will result in additional logging messages generated and retained.

Setting: Used to toggle the specified build flag. The possible values are:

- ***OFF:** Change the above flag to off.

- ***ON:** Change the above flag to on.

CHGBRMSOBJ - Change BRMS Object Attributes

This command allows you to change an attribute of a BRMS object. It is particularly useful for programmatically changing values which do not have a BRMS command line interface.

```
                Change BRMS Object Attributes (CHGBRMSOBJ)

 Type choices, press Enter.

 BRMS Object type to change . . .   _____       *DEVICE, *MEDPCY, *CTLGATTR
 Name of BRMS object to change  .   _____       Object name
 BRMS Attribute to change . . . .   _____       *LOC, *MEDCLS, *MOVPCY...
 New attribute value  . . . . . .   _____
 _____
```

Object type to change: Specify the type of object to change. The objects which can be changed are:

- ***CTLGATTR:** The following control group attributes (WRKCTLGBRM opt 8) can be changed:
  - o *DEVICE

- ***DEVICE:** The following device attributes (WRKDEVBRM) can be changed:
  - o *LOC
  - o *TEXT

- ***MEDPCY:** The following media policy attributes (WRKPCYBRM) can be changed:
  - o *LOC

- o *MEDCLS
- o *MOVPCY
- o *MARKDUP
- o *MARKHST
- o *MINVOL
- o *TEXT
- o *VOLSEC

Name of BRMS object to change: Specify the name of the BRMS object to change.

BRMS Attribute to change: Specify the attribute of the object to change. The valid combination of object to change and the attribute to change varies.

- ***DEVICE:** Specifies the device(s) to be associated with the object. Only one device is currently supported. The possible values are:
  - o ***BKUPCY:** The value for the backup device field in this control group uses the default value for this field from the backup policy.
  - o ***SYSPCY:** The value for the backup device field in this control group uses the default value for this field from the system policy.
  - o device-name: Specify the names of the devices that are used in processing this backup control group. Only one device is currently supported.
  - o *NONE: There is no device for this save operation. Save files are used to store the saved data.
  - o *MEDCLS: Devices for this policy or control group are selected based on device types that support the density for the media class specified in the media policy. The *MEDCLS special value is used for devices that are part of a device pool, such as several systems that share a single or set of devices.

- ***LOC:**   Specifies the storage location to be associated with the object. The possible values are:
  - o *ANY: Any device in any location capable of saving to the specified media class can be utilized for the save operation.
  - o location-name: Specifies the location name of the device that is to be used with this policy. Only devices assigned this location name can be used for the save operation.

- ***MEDCLS:** Specifies the name of the media class to be used for any volume created using this media policy.The possible values are:
  - o *NONE: No media class is assigned for this media policy.
  - o *ADSM: No media class is assigned for this media policy. The media is managed by the TSM server.
  - o media-class-name: Specify the name of the media class that is to be used with this media policy.

- ***MOVPCY:** Specifies the name of the move policy to be associated with this object. The possible values are:
  - o *NONE: Specifies that no move policy is associated with this media policy.

- o *ADSM: Specifies no move policy is associated with this media policy. A TSM server is responsible for movement and storage of the media.
  - o move-policy-name: Specifies the name of the move policy that is to be assigned to volumes used by this media policy.

- ***MARKDUP:** Specifies whether history items created by the save will be marked for duplication. You can use DUPMEDBRM VOL(*SRCHHST) command to duplicate the marked saved items. The possible values are:
  - o *NO: History items created during a save operation that use this media policy will not be marked for duplication.
  - o *YES: History items created during a save operation that use this media policy will be marked for duplication.

- ***MARKHST:**Specifies whether media volumes will be marked for duplication. If a volume is a member of a media set and it is marked for duplication, all members of the media set will be marked for duplication. When the DUPMEDBRM VOL(*SEARCH) command is used, active volumes that have been marked will be selected and duplicated. The possible values are:
  - o *NO: Volumes written to during a save operation that use this media policy will not be marked for duplication.
  - o *YES: Volumes written to during a save operation that use this media policy will be marked for duplication.

- ***MINVOL:** Specifies the minimum number of expired volumes that must be present before any save can begin. The possible values are:
  - o *NONE: There is no check done to determine the minimum number of required volumes before a save operation begins.
  - o number-of-required-volumes: Specify the number of expired media volumes that must be available before any BRMS save operation will begin. The number of volumes can range from 1 to 9,999.
- ***TEXT:** Specifies text that describes the object. The possible values are:
  - o *NONE: No text will be used to describe the object.
  - o text-description: Specifies the text description to be used.

- ***VOLSEC:** The secure volume attribute will be changed. Value values are:
  - o *NO: Volume security will not be applied to this media class. Volumes that do not have volume security can be read by anyone.
  - o *YES: Volume security will not be applied to this media class. Only users with special authorities *ALLOBJ or *SECADM can read media volumes in this media class.   *
  - o *ADSM: Volume security will not be applied. Volume security is managed by the TSM server.

New attribute value: Specify the new value value.

CHGCSECRDE - Change CSE Credential Entry

This command can be used to change a user credential entry in the Device Domain Data associated with IBM i Copy Services Manager. The information is encrypted using a 128 bit AES key before it is retained.

For a description of the parameters, see the command ADDCSECRDE.

CHGCSEDTA – Change CSE Data

CHGCSEDTA is used to change the CSE Data as it relates to the operational characteristics of the toolkit. The parameters of CRTCSEDTA and DSPCSEDTA are similar and these descriptions apply to those commands as well. Please refer to CRTCSEDTA for parameter details.

CHKFSFLASH - Check Full System Flash

The Check Full System FlashCopy Readiness (CHKFSFLASH) command performs checks to determine if the prerequisite conditions have been met for the identified CSE Data configuration to be able to perform a Full System FlashCopy via STRFSFLASH. Depending on whether the CSE Data refers to a Full System Flashcopy (FSFC) or Recovery Point Flash (RPF) the command will perform different steps. In both situation the purpose is to check whether the conditions are correct for a flashcopy. This command is not able to detect all conditions that could cause a STRFSFLASH command to fail, however, it will check the following:

- o For DS8K environments, a flash relationship exists.
- o For SVC environments, the consistency group and flashcopy mappings exist.
  - o For RPF, the target LUNs must not have host connections
- o The smc or svc is available
- o The source partition is available
- o The HMC for the source partition is available.
- o The HMC for the target partition is available.
  - o For RPF, there is no target partition.
- o For SVC, that all host connections are valid.
- o That no other instance of STRFSFLASH for this configuration is active.
- o That the shutdown command is valid on the source partition.
- o The cluster on the required nodes are operational.
- o That all nodes are in the correct cluster domain.

The following checks are only made for FSFC operations:

- o That device and line descriptions in the configuration exist on the source partition.
- o That the BRMS port is available.
- o That the backup commands are valid on the source partition.
- o That the BRMS media classes are valid.

This command should be run in an attempt to pro-actively identify any conditions that must be corrected before STRFSFLASH can be completed successfully for the specified CSE Data configuration.

CSE Data name: This is a required parameter. Specifies the name of the CSE Data that contains the flashcopy configuration.

Controller IP address: Specifies the IP address on the controlling node where the processing for the CHKFSFLASH command will be performed. The possible values are:

- ***LOCAL:** The local system is the controller.

- **IP address:** IPv4 formatted address

Controller port: The port on which the controller is listening for remote commands.
This parameter is ignored for CTLR(*LOCAL).

CHKRCYPNT – Check Recovery Point Flash

The Check Recovery Point Copy Readiness (CHKRCYPNT) command performs checks to determine if the prerequisite conditions have been met for the identified CSE Data configuration to be able to switch the partition LUNs to a recovery point copy via SWRCYPNT. This command is not able to detect all conditions that could cause a SWRCYPNT command to fail, however, it will check the following:

- That the environment is an SVC environments.
- That the consistency group and flashcopy mappings exist.
- The smc or svc is available.
- The source partition is available
- The HMC for the source partition is available.
- That all host connections are valid.
- That no other instance of STRFSFLASH for this configuration is active.
- That the shutdown command is valid on the source partition.
- The cluster on the required nodes are operational.
- That all nodes are in the correct cluster domain.

This command should be run in an attempt to pro-actively identify any conditions that must be corrected before SWRCYPNT can be completed successfully for the specified CSE Data configuration

CSE Data name (CSEDTA) This is a required parameter. Specifies the name of the CSE Data that contains the flashcopy configuration.

CLNICSMLOG – Clean ICSM Log

This command will clean the logs related to the IASP Copy Services Manager, Full System Replication Manager, or Full System FlashCopy Manager. CLNICSMLOG removes specified entries from the /QIBM/Qzrdhasm/Qzrdhasm.log, removes any temporary directories created by DMPINF, dmpinf zip files and toolkit joblogs in /QIBM/Qzrdhasm/joblogs/ which are older than the number of days specified on this command. This command should be run periodically to prevent log files from consuming excessive space.

Days of information to retain: How many days of information to retain.

FSFC environment: The name of the FSFC environment to be cleaned.

- ***NONE:** Do not clean up the logs for any environment.

- ***ALL**: Clean up the logs for all environments.

- **environment-name:** Clean up the logs for the named environment.

CLRDDD – Clear Device Data Domain

CLRDDD is a utility command used to clear data out of PowerHA device data domains. It should only be used when instructed by IBM personnel and may remove toolkit configuration data.

CNLFSFLASH – Cancel Full System FlashCopy

Cancel a FlashCopy previously paused with STRFSFLASH. This is necessary if the intent is to issue another STRFSFLASH instead of RSMFSFLASH.

CPYCSEDTA – Copy CSE Data

This interactive command will create a new Cluster Resource Group and write configuration data to the CSE Data device domain based on information from an existing CRG and existing CSE Data. The configuration data may be modified before the CSE Data is created.

Please refer to the command CRTCSEDTA for a detailed description of the parameters.

CSE Data name: The name that identifies both the CRG and the CSE Data.

To CRG: Specifies the name of the CRG device which is to be prepared for backup. This name identifies a CRG device description on the owning cluster node. This is also the Environment name referenced elsewhere within ICSM. The environment is configured using WRKCSE.

CRTCSEDTA - Create Copy Services Environment Data

CRTCSEDTA is used to enter the CSE Data as it relates to the operational characteristics of the toolkit. The parameters of CHGCSEDTA and DSPCSEDTA are similar and these descriptions apply to those commands as well.

```
                          Create CSE CRG

 Supply all required values, press Enter.

 CRG Name . . . . . . . . . . . :    TEST

 Use  . . . . . . . . . . . . . :    *SYSTEM

 Copy type  . . . . . . . . . .      *FLASH       *PPRC, *FLASH
```

The CRG Name can be different from the environment name. Entering use *SYSTEM and type *FLASH indicate this is going to be a CSE Data for Full System FlashCopy. Press Enter and the remaining FSFC-specific parameters are displayed.

```
                    Create Full System FlashCopy CSE Data

 Supply all required values, press Enter.

 CSE Data Name  . . . . . . . :    TEST
 Use  . . . . . . . . . . . . :    *SYSTEM
 Copy type  . . . . . . . . . :    *FLASH

 Environment  . . . . . . . .      _____        Name
 Primary controlling node . .      _____        Name
 Secondary controlling node        _____        Name
 Communications port  . . . .      55920_____

 Source LPAR IP address . . .      _____   IPv4 address
 Source host alias  . . . . .      _____        Name
 Target host alias  . . . . .      _____        Name
```

Environment: Refers to the environment previously created in WRKCSE. This must be an FSFC environment, and determines the external storage details. It is common for multiple CSE Data's to reference the same environment to facilitate daily vs. weekly backups. Note that only one FlashCopy using a specific environment can be executed at a time.

Primary and Secondary controlling nodes: Enter the cluster node names of the controllers. There is no practical distinction between primary and secondary nodes. If there is only one node, do not enter a secondary node.

Communications port: The port on the source LPAR the controllers will use to communicate with the source and target LPARs. Program QZRDIAEXT2 in subsystem QZRDFSR is expected to be listening to this port when the FlashCopy operations are performed.

Source LPAR IP address: The IP address the controlling and target LPARs will use to contact the source LPAR.

Source and Target Host alias: These labels are used in the messages to identify which LPAR the message is referring to.

```
Method to flush memory . . .    *FRCWRT___           *QUIESCE, *FRCWRT, *IPL
```

Method to flush memory: The FlashCopy will only copy the data which is on disk, not that which is in the host's memory. Therefore, it is important that we flush as much data as possible from memory to disk prior to the FlashCopy. There are three methods we can use to achieve this:

- ***FRCWRT**: **FRCWRT has minimal impact to users, and is typically a good option to use when testing the FlashCopy process, or when creating a FlashCopy for non-backup purposes.* This option will flush memory but will not hold any database transactions. Users will not be impacted beyond additional disk I/O created to perform the flush. Neither TCP nor jobs, processes or subsystems are ended. Once the flush operation has finished, the toolkit will perform a FlashCopy in the storage, capturing whatever is on disk. There is an increased possibility that some objects may be damaged on the FlashCopy. The IPL of the FlashCopy LPAR may take a long time as database and journal recovery may need to roll back many transactions. Futhermore, it is not recommended to use *FRCWRT unless the items being backed up are journaled, as files may have partially written records (applications may not tolerate improperly formatted data, such as NULL values in zoned integer fields, etc).

```
Method to flush memory . . .    *QUIESCE             *QUIESCE, *FRCWRT, *IPL
Quiesce details:
  Maximum time quiesced  . .    59                   0-240 seconds
  Force flash copy . . . . .    *YES                 *YES, *NO
```

- ***QUIESCE**: *Use this option for minimal impact to users and to get a good FlashCopy for backups.* The *QUIESCE option will first perform a *FRCWRT, then it will perform a *SUSPEND operation, followed by another *FRCWRT before the FlashCopy is executed. The purpose of the first *FRCWRT is to flush as much memory as possible before suspending database transactions (it could take 10-20 minutes to flush terabytes of memory on a busy system). Before suspending transactions the toolkit will spawn a second job which will automatically resume the system after a certain time period, to ensure that a failure or pause in the main toolkit process will not prevent access to the system longer than desired. During the *QUIESCE process, new database transactions will be suspended while allowing existing transactions to reach a commit boundary. The "**Maximum time quiesced**" parameter determines how long to wait for the transactions to reach a commit boundary. When all the transactions are held, the FlashCopy will occur. If there remains outstanding transactions, the

toolkit will perform a flash anyway if the "**Force flash copy**" option is selected, as it is likely that many transactions were held. Otherwise the process will fail.

```
Method to flush memory . . .    *IPL               *QUIESCE, *FRCWRT, *IPL
IPL details:
  Power down command . . . .    pwrdwnsys delay(30)


  Confirmation message . . .    *NO                *YES, *NO
  Source LPAR Information:
    HMC LPAR name  . . . . .    ctciha9m
    HMC Profile name . . . .    ctciha9m
    HMC managed system . . .    CTCHA9
    Primary HMC IP . . . . .    9.5.168.29         IPv4 address
    Secondary HMC IP . . . .                       IPv4 address
```

- ***IPL**: By powering down the source LPAR we are ending all transactions and processes and moving all data from memory to disk. *This will create the best possible FlashCopy to perform backups from, but also has the greatest impact to the users of the source LPAR.*
  The *IPL option will (by default) issue and wait for a response to an inquiry message on the source LPAR, in QSYSOPR's message queue. This confirmation can be removed by selecting *NO on the "**Confirmation message**" parameter. The benefit of having a confirmation message is 1) validates the correct LPAR is being shut down and 2) provides the option to prevent the shutdown.
  If *IPL is used, a "**Power down command**" must be supplied. This command can be PWRDWNSYS RESTART(*NO) (we recommend a 30-second [or longer] delay) or a command or program call which will terminate processes and applications then do a PWRDWNSYS RESTART(*NO).

  Source LPAR Information is only displayed if the method to flush memory is set to *IPL. The **HMC LPAR name, HMC profile name,** and **HMC managed system** parameters are case sensitive. The **Primary HMC IP** is required and **Secondary HMC IP** is optional. If the toolkit receives an unexpected response from the currently used HMC it will automatically retry the response on the other HMC, if it is configured.

```
Target LPAR Information:
  HMC LPAR name  . . . . . .    ctciha9n
  HMC Profile name . . . . .    ctciha9n
  HMC managed system . . . .    CTCHA9
  Primary HMC IP . . . . . .    9.5.168.29         IPv4 address
  Secondary HMC IP . . . . .                       IPv4 address
  Shutdown target before
    FlashCopy  . . . . . . .    *YES               *YES, *NO
  Restart target after
    FlashCopy  . . . . . . .    *YES               *YES, *NO, *INQ
```

Target LPAR Information: Specify the details for the target LPAR. The **HMC LPAR name, HMC profile name,** and **HMC managed system** parameters are case sensitive. The **Primary HMC IP** is required and **Secondary HMC IP** is optional. If the toolkit receives an unexpected response from the currently used HMC it will automatically retry the response on the other HMC, if it is configured.

Shutdown target before FlashCopy: It is necessary to deactivate the target LPAR prior to performing a FlashCopy if the target LPAR is attached to the FlashCopy disks. For example, if two source LPARs with dedicated target disks share a common target LPAR, it is not necessary to shut down the target LPAR if it is not attached to the FlashCopy target disks.

Restart target after FlashCopy: The toolkit has several options for restarting the target LPAR. Note that if host connection changes are specified, they will be processed immediately prior to activating the target LPAR.

- ***YES**: Restart the target LPAR immediately after the FlashCopy. This is the most common option. If there are multiple STRFSFLASH operations vying for the use of the target LPAR, one will randomly get a lock on it and the rest will continue to wait until they can also get a lock on it.

- ***NO**: Do not restart the target LPAR after the FlashCopy. Some customers use this to create a FlashCopy immediately before a critical operation on the source LPAR, such as batch processing, for the purposes of performing a reverse FlashCopy. Backups are not usually performed in this scenario.

- ***INQ**: Issue an inquiry message to QSYSOPR on the controller prior to restarting the target LPAR to allow an operator to control whether and when to start the target LPAR. This can also be used with multiple concurrent STRFSFLASH operations to control the order of target LPAR IPL's.

- ***PAUSE:** The Full System FlashCopy process will be paused at the point immediately after the flashcopy has completed and prior to the start of the IPL of the target partition. Use the Resume Full System FlashCopy (RSMFSFLASH) CL command to resume the process.

```
Use BRMS integration . . . .    *YES                *YES, *NO
BRMS information:
  Lock BRMS  . . . . . . . .    *SRCONLY            *BOTH, *NO, *SRCONLY,
                                                      *TGTONLY
  Lock type  . . . . . . . .    *FCNUSG             *ALL, *FCNUSG, *HOLD
  Base media class . . . . .    *NONE               class, *NONE
  Base media class suffix       *NONE               suffix, *NONE
  BRMS transfer method . . .    *ALL                *ALL, *CHGONLY
  BRMS transfer port . . . .    *DFT                *DFT, 1024-65535
  BRMS save compression  . .    *DEV                *DEV, *YES, *NO, *HIGH,
                                                      *MEDIUM, *LOW
  Restricted media class(es)    *NONE               *NONE, class
      + for more values  . .
```

Use BRMS integration: Controls whether the toolkit will integrate with BRMS. If set to ***NO**, the toolkit will not change the BRMS FlashCopy mode, manage journaling of files, lock users out of BRMS on the source, or transfer BRMS back, etc. ***YES** will enable the **BRMS information** parameters.

Lock BRMS: Determines whether BRMS operations should be prevented and on which LPARs.

- ***SRCONLY** is the recommended value, which will only lock BRMS on the source LPAR during the backups on the target LPAR. The purpose of locking BRMS on the source LPAR is to prevent activities that will change the BRMS database that will later be overwritten when QUSRBRM is copied from the target LPAR. This is the recommended value when the **BRMS Transfer method** is ***ALL**.

- ***TGTONLY** will only lock BRMS on the target LPAR after the BRMS database has been transferred to the source LPAR. The purpose of locking the database on the target LPAR after the backups is to prevent performing changes to the BRMS database there after it has been copied back to the source LPAR. These changes will be lost. If there is limited access to the target LPAR after the FlashCopy has finished (i.e. it is deactivated, 5250 is not started etc) there may be no reason to lock the target LPAR.

- ***BOTH** will perform both ***SRCONLY** and ***TGTONLY** locks.

- ***NO** will not perform any BRMS locking. This is the recommended value when the **BRMS transfer method** is ***CHGONLY**.

Lock type: If locking of BRMS is desired, how it is locked can be decided.

- ***FCNUSG** will use the functional usage model to prevent backups from occurring. Recoveries and viewing logs, media and history is allowed. Attempts to change the BRMS database (i.e. backups, editing control groups etc) will be denied with a message indicating the user is not authorized to that function. Use WRKFCNUSG to view/change individual functional areas. To temporarily override the lock, use the command SETUSRBRM to give *ADMIN to a user to perform a locked function. This authority will be reset to the pre-FlashCopy state after the BRMS database has been transferred back to the source LPAR.

- ***HOLD** will use the BRMS 'halt' method to hold any jobs accessing BRMS. This method's purpose is to allow BRMS to force an exclusive single-threaded environment for critical functions such as STRMNTBRM. To remove this lock, perform this program call:

```
QSYS/CALL PGM(QBRM/Q1AOLD) PARM('STOPJOBS ' '*RELEASE ')
```

Or delete data area QUSRBRM/Q1AMNTHALT.

- ***ALL** will implement both ***HOLD** and ***FCNUSG**

- ***NONE** will not implement any locking mechanism and is appropriate when using **BRMS Transfer method *CHGONLY.**

Base media class: Only use this option with **BRMS transfer method *CHGONLY.** When using dynamic media classes, the toolkit will create a new media class from an existing base media class. The new media class will be named using the base media class and the **Base media class suffix**. The combined length of these two must be less than ten characters. The dynamic media class is created

immediately prior to the FlashCopy, and is added to the **Restricted media class** list. Media previously used in a dynamic media class will be moved to the dynamic media class, and scratch volumes will also be moved to it. The toolkit will find all the media policies which use the base media class and specify the same media location as the device location of the devices specified on the CRTCSEDTA command, and use the "Required Volumes" parameter to determine how many scratch media are required at each location. The toolkit will move that number of expired media to the dynamic media class. After the backups are finished the toolkit will write the text '#FSFC#' to the media used during the backup to identify for future use in a dynamic media class. Then the media will be moved back to the base media class and the dynamic media class will be removed.

BRMS transfer method: This parameter determines how to transfer the BRMS database from the target to the source LPAR. This process is triggered when ENDFSFLASH *NORMAL is called on the target LPAR.

- ***ALL** will transfer the entire BRMS data library (QUSRBRM). This is the BRMS-supported method of managing the FlashCopy data, and will also perform the BRMS operations to set the proper BRMS FlashCopy mode. The entire library is placed into a savefile and transferred to the source LPAR using a proprietary file transfer protocol. Since the entire QUSRBRM is moved, overwriting what is on the source LPAR, any updates to the source LPAR QUSRBRM after the FlashCopy will be overwritten. This is why it is important to lock QUSRBRM on the source LPAR to prevent backups until QUSRBRM has been restored from the target LPAR. *ALL is by far the most common and least complicated option used to transfer the BRMS data.

- ***CHGONLY** will only move the updates to the media and object detail created during the backup on the target. While this will result in significantly less data to transfer, more time is spent extracting the data from the target QUSRBRM and inserting it into the source QUSRBRM that there is little, if any, improvement in the overall data transfer time. *CHGONLY was created to allow customers to perform backups on the source LPAR simultaneously with the backups on the target LPAR, or when using the toolkit to run multiple concurrent FlashCopy operations from a single source LPAR. When the BRMS data is transferred back to the source LPAR, it only only update media either expired or owned by the source LPAR so it is important to not override or reuse media classes assigned to the target LPAR. When the data is transferred back to the source LPAR, it is done in two steps; the media inventory and save history will quickly be transferred (as it has less data) which releases the media classes used. Then the second stage will transfer the object detail, which can potentially take hours. It is also important to note that each target LPAR must have its own media class, specified either as a restricted media class or dynamic media class. *CHGONLY was developed with the help of the BRMS developers, but is not the BRMS-supported method to manage the BRMS database during FlashCopy (it is supported by the toolkit). It introduces significant complexity and possibility for error, and is usually discouraged unless the customer has a specific need for the benefits.

BRMS transfer port: This is the port the toolkit will open on the source LPAR to receive the BRMS database. *DFT will attempt to select port 55066; if it is not available it will search subsequent ports until one is available.

BRMS save compression: Specify the compression used when saving BRMS to the savefile. *DEV is the default, but *MEDIUM is recommended.

Restricted media classes: When a BRMS media class is placed in this list, the toolkit will remove the functional authority to it on the source LPAR, and remove the functional authority to all others on the target LPAR. After the backups the functional authority will be restored on the source LPAR. Dynamic media classes are automatically added to the restricted media class list.

```
Target Comm Interfaces:

  IO card location code  . .   U8233.E8B.10001AP-V4-C2-T1
                                                *NONE, identifier
  Line Description . . . . .   FSFCLINE          line name, *VIRTUALIP
  IP interface . . . . . . .   9.5.167.93        IPv4 address

      + for more values  . .

Target LPAR default route:
  Binding interface  . . . .   *NOCHANGE         IPv4 address
  Next hop . . . . . . . . .                     IPv4 address
```

Target Comm Interfaces: The target LPAR should come online with a different IP address than the source LPAR. Use these parameters to indicate which IP addresses and line descriptions to bring online.

- **IO card location**: Specify the target IO card location which should be associated with the specified line description.

- **Line description**: The line descriptions specified will be modified with the resource name associated with the IO card location, and it will be varied on. All other line descriptions will be set to ONLINE(*NO). This line description must exist on the source LPAR, with an invalid resource name and ONLINE(*NO).

- **IP interface**: The IP interface which will be started. STRTCP will be called but no interfaces will be auto-started. This interface must exist on the source LPAR with AUTOSTART(NO). The toolkit will set this IP interface to be the BRMS restricted state IP interface.

Target LPAR Default Route: If the target LPAR IP address is in a different subnet and/or requires changes to the routing tables, use these parameters. If a new default route is specified, the existing one will be removed.

- **Binding interface**: Specify the interface to use for routing.

- **Next hop**: Specify the next for the default route.

```
Target LPAR Device Setup:

  Backup device description    TS3400PROD         *NONE, device name
```

```
   Device serial number . . .    78-78F1101

        + for more values   . .

Target LPAR backup command     *NONE


        + for more values   . .
```

Target LPAR Device Setup: This is used to work with devices to ensure that they are in the correct state for BRMS or other backup to use. When the target LPAR IPL's, it will find the devices and auto-configure them to use the next available resource name.

- **Backup device description**: Specify the device description the backups are configured to use. This must exist on the source LPAR prior to the FlashCopy. This can be a tape drive or media library device description.

- **Device serial number**: Enter the device serial number from WRKHDWRSC *STG option 7. The toolkit will look for the specific serial number in WRKHDWRSC and determine the resource name which will be used on the specified device description. The serial number can be for a tape drive or a media library.

If there are multiple logical libraries in the media library then specify a media library device description with the serial number of a tape drive assigned to the logical library. The toolkit will then use the tape drive resource's parent library description to ensure the correct logical library is used.

All device descriptions will be varied off prior to varying any on.

Target LPAR backup command: Specify the backup commands to be issued by the toolkit. Prior to calling any of these commands, the toolkit will have started the specified IP interface. To prevent accidentally starting applications, the startup program has been changed to *NONE, line descriptions set to not vary on at *IPL, and TCP is set to not start on IPL. These are considerations to be taken when restoring from the backups.

These commands are issued in sequence. Processing will halt if any issue an escape message. The commands are executed as QLPAR in QSTRUPJD.

```
Wait for ENDFSFLASH  . . . .    *YES              *YES, *NO
FlashCopy Exit program . . .    *NONE
  Library  . . . . . . . . .      *LIBL           *LIBL, library
Hold scheduled jobs  . . . .    *YES              *YES, *NO
Target keylock position  . .    *AUTO             *PANEL, *AUTO, *MANUAL
Stop target after backups       *NO               *YES, *NO, *RMV

Request type . . . . . . . .    0                 Number
Auto start cluster . . . . .    *YES              *YES, *NO
Wait time  . . . . . . . . .    0                 Number of seconds
Message Queue  . . . . . . .    *SYSOPR           name, *SYSOPR
```

```
  Library  . . . . . . . . .                           library name

Text . . . . . . . . . . . .
```

Wait for ENDFSFLASH: ENDFSFLASH is the command that will notify the toolkit that the backups have finished.

- ***NO**: The toolkit will not wait for ENDFSFLASH to be called. It will be processed implicitly when the backup commands have all completed without issuing an escape message. Note that the toolkit is not able to monitor submitted backups.

- ***YES**: The toolkit will wait for ENDFSFLASH to be called. This is expected to be submitted from the last *EXIT in a control group, in SAVSYSBCH, a command line, etc. If any backups are submitted (for example to the controlling subsystem) *YES is the correct option.

Flash Copy Exit Program: The FlashCopy Exit Program is described elsewhere in this guide. It's purpose is to allow for additional custom automation steps.

Hold scheduled jobs: This applies only to the basic job scheduler. The job entries are held immediately at the beginning of the startup program.

Target keylock position: Indicate how to start the target LPAR.

- ***AUTO**: Start the LPAR in automatic / unattended mode. This is the recommended option.

- ***MANUAL**: Start the LPAR in manual / attended mode. The recommendation is to use this option the first FlashCopy to bring the LPAR up in restricted state and verify the startup program is properly set. This will validate that the correct LUNs are being FlashCopied.

- ***PANEL**: Use the default setting as defined in the HMC.

Stop target after backups: After the backups (and QUSRBRM transfer) the toolkit can deactivate and remove/stop the FlashCopy relationship.

- ***NO:** Do not deactivate the target LPAR after backups. The LPAR will remain running, using CPU and memory resources.

- ***YES:** Deactivate the LPAR from the HMC. The FlashCopy will remain active so the LPAR can be IPL'd later. This will free up CPU and memory resources and prevent users from accidentally signing on to the LPAR.

- ***RMV:** The LPAR will be deactivated and the FlashCopy relationship will be stopped / removed. The LPAR cannot be IPL'd until another FlashCopy is performed. This is the best option if using thin provisioned or space efficient FlashCopy.

Request type: Internal code used by the toolkit to record it's state. In the case of a restart, this should be manually changed to 0.

DLTCSEDTA - Delete CSE Data

This command will delete the specific CSE Data from the CRG device domain data. It also deletes the CRG.

CSE Data name: The name that identifies the CSE Data.

DSPCSEDTA - Display Copy Services Data

This interactive command displays the specific CSE Data configuration information in the CRG device domain data space. It also displays CRG exit data.

CSE Data name: Specifies the name of the CSE Data and the exit data that is to be displayed.

DSPDDDLCK - Display DDD lock holder

This is a utility command for display the job and user who holds a cluster-wide lock on the specified artifact. This command should be used if a log message indicates a lock is preventing an operation.

Name: Enter the name of the object to display a lock for.

Type: Enter the type of object to display a lock for.

ENDFSFLASH - End Full System Flash

Notifies the controlling partition that backups are finished.

Action: Indicates whether the backups finished successfully or failed.

- ***NORMAL:** The backups finished with success. Will trigger moving QUSRBRM to the source partition if configured. The source partition will become the active BRMS instance. This is valid to run on the target partition.

- ***FAILBKU:** The backups did not finish with success. Will not move QUSRBRM to the source partition. The source partition will become the active BRMS instance. This is valid to run on the target partition.

- ***RSTFCNUSG:** Restore the Functional Usage values which were saved prior to the FlashCopy. Use this option if the backups or transfer of BRMS from the target partition failed and you will discard the BRMS backup history changes on the target partition. This is valid to run on the source partition.

- ***CLNDYNMED:** Clean up the dynamic media class. This will mark and move any media in the specified media class to the base media class.

Config: Specifies a configuration If used with ACTION(*RSTFCNUSG) this will restore the restricted media classes provided in the specified configuration. This may be further limited with the MEDCLS parameter.

- ***DFT:** The toolkit will use the standard configuration, typically only used with LOCKBRMS(*BOTH).

- ***MEDCLS:** Restore the function usage for the specified restricted media classes specified on the MEDCLS parameter, regardless which configuration they may be associated with.

- **Config-name:** The toolkit will use the configuration specified. You must specify the configuration if you have multiple flashcopies sending BRMS back to the source LPAR, or if using restricted media classes.

Media class: Specifies which media classes to restore function authority for or to clean up the dynamic media in. If a configuration is specified on the CONFIG parameter, only the function authorities for the media classes associated with the specified configuration will be restored.

- ***ALL:** All of the outstanding media class function authorities associated with the specified configuration will be restored.

- **Config-name:** Only the function authorities for the specified media class will be restored.

Base media class: If *CLNDYNMED is specified on the ACTION parameter, the Base Media Class specifies the class to merge the dynamic media class into.

- ***NONE:** This parameter is ignored.

- **Media-class-name:** Specifies the base media class.

Dynamic media class: If *CLNDYNMED is specified on the ACTION parameter, the Dynamic Media Class specifies the class to merge into the base media class. The dynamic media class will then be removed.

- ***NONE:** No media will be merged.

- **Dynamic-media-class-name:** The media class to merge from and remove.

IPLLPAR – IPL Partition

This command will activate the specified LPAR.

HMC partition name: Specify the name of the LPAR to activate. This parameter is case sensitive.

Partition profile: Specify the partition profile to use when activating the partition. This parameter is case sensitive.

- ***LPARNAME:** The name of the profile is the same as the partition name.

Managing system: The managed system name must be specified. This parameter is case sensitive.

Primary HMC IP address: Enter the IP address of the primary HMC. This address must have credentials listed in WRKCSECRDL.

Secondary HMC IP address: Enter the IP address of the secondary HMC. This address must have credentials listed in WRKCSECRDL. This IP address is optional and will only be used if an unexpected response is received from the primary HMC.

IPL Source: Specifies whether an initial-program-load (IPL) is started from the A-source, B-source or D-source of the system. This parameter allows you to control which Licensed Internal Code (LIC) storage source of the system to IPL. Also, the source of the system determines where LIC program temporary fixes (PTFs) are applied. This parameter also allows the system to be upgraded to a new release from an install image on DASD.

LIC has three storage areas known as the A-source, the B-source and the D-source. The D-source is the install media. The A- and B-sources are part of the system memory. Initially, the A- and B-sources are identical, but when Licensed Internal Code fixes are performed temporarily (PTF), the temporary fixes are stored on the B-source. When the same fixes become permanent, they are copied from the B-source to the A-source; therefore, the fixes reside on both the A-source and the B-source.

When you want to send temporary fixes to the B-source, you must start the system from the A-source, which causes the fixes to be sent to the B-source.

When you start the system from the A-source, you are running the system from the permanent fixes. When you start the system from the B-source, you are running the system from a mixture of temporary and permanent fixes. When you start the system from the D-source, you are using the Licensed Internal Code loaded from the install media.

It is recommended that you specify RESTART(*YES); otherwise, you cannot be assured which source of the system is actually started. This precaution can save you some time.

- ***PANEL:** The partition is started from the source that is currently shown on the operator's panel, the A-source, the B-source, or the D-source.

- **A:** The partition is started from the A-source.

- **B:** The partition is started from the B-source.

- **D:** The system is started from the D-source, the install media.

Keylock position: Specifies whether the LPAR will be activated for attended (manual) or unattended (auto) mode.

- ***PANEL:** The partition is started in the mode that is currently shown on the operator's panel.

- ***AUTO:** The partition is started in unattended mode.

- ***MANUAL:** The partition is started in attended mode.

Block until LPAR is active: This parameter determines whether IPLLPAR will return control to the caller immediately or after the LPAR has reached the "Running" state.

- ***YES:** IPLLPAR will remain active until the LPAR has reached a "Running" state.

- ***NO:** IPLLPAR will terminate immediately after activating the LPAR.

Max minutes to block: Specifies how long IPLLPAR will wait for the partition to reach a "Running" state. This is ignored if **Block until LPAR is active** is *NO. If the partition does not enter the "Running" state before the specified number of minutes has elapsed, IPLLPAR will issue and escape message.

Confirm activation: Configures IPLLPAR to wait on an inquiry message before activating the partition.

- ***YES:** IPLLPAR will issue an inquiry message and will wait for a positive response before activating the partition.

- ***NO:** IPLLPAR will activate the partition immediately.

LOGMSG – Log Message

The default log is in /QIBM/Qzrdhasm/qzrdhasm.log but some toolkit processes will change to a different log. LOGMSG will insert the specified message to the current log in use by the job.

Message: Enter the message to be inserted, from 20-120 characters.

Message format: Determines how the message will look in the log.

- ***STD:** Use the standard message format. An example:

    2017-07-27 12:46:00   standard message (logmsg)

- ***CMDSTR:** Use the 'command start' message format. An example:

    682401 2017-07-27 12:51:10 Start command start message starting from job
    682401/AASLAND/QPADEV001Q

Message type: Indicates the message status tag. The possible values are:

- ***INFO:** The message does not have a tag.

- ***ERROR:** The message is tagged with 'Error'

- ***WARNING:** The message is tagged with 'Warning'

PRTCSE – Print CSE Information

The PRTCSE command prints Copy Services Environment (CSE) information, that was entered by the WRKCSE command and stored in cluster Device Domain Data (DDD). The information is printed to a QPRINT spool file. Unlike the environment list generated within WRKCSE, this command can access defined enviromnents from any node within the cluster. Any combination of ENV and TYPE parameter values may be used.

Environment name: Specifies the name of the environments for which all information is to be dumped. The possible values are:

- ***ALL:** All types of environments with the Copy Service Type below or all environments may be dumped.

- **Environment name:** All types of environments with the supplied environment name may be dumped.

Copy Service Type: The type of Advanced Copy Service enviromnent. This parameter is required. The possible values are:

- ***ALL:** All types of environments with the environment name or all environments may be dumped.

- ***FLASH:** The FlashCopy environment with the environment name or all FlashCopy environments may be dumped.

- ***GMIR:** The PPRC Global Mirroring environment with this environment name or all GMIR environments may be dumped.

- ***LUN:** The LUN Level connection switching environment with this environment name or all LUN environments may be dumped.

- ***MMIR:** The PPRC Metro Mirroring environment with this environment name or all MMIR environments may be dumped.

RLSCSELCK - Release Copy Services Lock

This command releases a cluster wide environment lock used within IASP Copy Services Manager.

Environment name: Specifies the name of the Environment (which may be an Independent ASP). A special value of *ALL may be used with RLSTYPE(*OVR) to override all ICSM locks for the cluster.

Release type: The possible values are:

- ***JOB:** Releae the lock that is held by this process.

- ***OVR:** Release a cluster wide environment lock which may be held by another process or when used with ENV(*ALL), release all ICSM locks for the cluster. Use this only to override locks held by processes which are no longer active.

RMVCSECRDE - Remove CSE Credential Entry

This command can be used to remove a user credential entry from the Device Domain Data associated with IBM i Copy Services Manager.

Host IP address: The address of the host to be removed.

RSMFSFLASH – Resume Full System FlashCopy

The Resume Full System FlashCopy (RSMFSFLASH) command resumes the processing of a previous invocation of Start Full System FlashCopy (STRFSFLASH) from the point immediately after the

flashcopy and prior to the IPL of the target partition. The Restart Target parameter in the CSE Data must have been set to *PAUSE.

RSTDDD – Restore Toolkit Device Data Domains

The Toolkits uses Device Data Domains (DDD) to store WRKCSE, WRKCSEDTA and WRKCSECRDL information. Use RSTDDD to restore the DDD from files created by SAVDDD.

The sole parameter is the path to the directory which contains the DDD backup files generated by SAVDDD.

RTVINF - Retrieve ICSM Information

The Retrieve Information (RTVINF) command retrieves specific information from IASP Copy Services Manager. This command is only valid when executed within a CL program.

Environment name: This is a required parameter. Specifies the name of the Environment (which may be an Independent ASP) for which information is to be retreived.

Information: This is a required parameter and specified the type of information to be returned. The possible values are:

- ***CLUNODENAME:** The node name of this system within the cluster. The length of the first CL return variable below must be at least eight characters.

- ***FLASHNODES:** The backup Flash Copy node names for the Flash configurations. Up to six FlashCopy environments may be configured. All six CL return variables must be specified and each of their lengths must be at least eight characters.

- ***FLASHSTATUS:** First Flashcopy status. The length of the first CL return variable below must be at least three characters.
    - o 0 = Ready
    - o 100 = Flashed
    - o other number = Flash in process
    - o blank = undetermined.

- ***FLASH2STATUS:** Second Flashcopy status. The length of the first CL return variable below must be at least three characters.
    - o 0 = Ready
    - o 100 = Flashed
    - o other number = Flash in process
    - o blank = undetermined.

- ***FLASH3STATUS:** Third Flashcopy status. The length of the first CL return variable below must be at least three characters.
    - 0 = Ready
    - 100 = Flashed
    - other number = Flash in process
    - blank = undetermined.

- ***FLASH4STATUS:** Fourth Flashcopy status. The length of the first CL return variable below must be at least three characters.
    - 0 = Ready
    - 100 = Flashed
    - other number = Flash in process
    - blank = undetermined.

- ***FLASH5STATUS:** Fifth Flashcopy status. The length of the first CL return variable below must be at least three characters.
    - 0 = Ready
    - 100 = Flashed
    - other number = Flash in process
    - blank = undetermined.

- ***FLASH6STATUS:** Sixth Flashcopy status. The length of the first CL return variable below must be at least three characters.
    - 0 = Ready
    - 100 = Flashed
    - other number = Flash in process
    - blank = undetermined.

- ***GMIRDIRECTION:** The length of the first CL return variable below must be at least one character.
    - N = Normal
    - R = Reversed
    - Blank = undetermined.

- ***GMIRNODEROLE:** This key value MUST replace any use of *PPRCNODEROLE for GMIR type environments, else unpredictable results may occur. The length of the first CL return variable below must be at least one character.
    - S = Source
    - T = Target
    - blank = undetermined

- ***GMIRSTATE:** The length of the first CL return variable below must be at least one character.
    - 0 = Stopped
    - 1 = Running
    - 2 = Failover
    - 3 = Suspended

- o 4 = Lagging
- o 5 = Extreme Lagging
- o 6 = Paused
- o 9 = Other
- o M = Multi-target Incremental Resync Pair
- o blank = undetermined. RTVLPARINF

- ***GMIRSTATEDIRECT:** State is returned in RTNVALUE and the direction is returned in RTNVALUE2. The length of the first and second variables must be at least one character.
  - o State (RTNVALUE):
    - ▪ 0 = Stopped
    - ▪ 1 = Running
    - ▪ 2 = Failover
    - ▪ 3 = Suspended
    - ▪ 4 = Lagging
    - ▪ 5 = Extreme lagging
    - ▪ 6 = Paused
    - ▪ 9 = Other
  - o Direction: (RTNVALUE2):
    - ▪ M = Multi-target Incremental Resync Pair
    - ▪ N = Normal
    - ▪ R = Reversed
    - ▪ blank = undetermined

- ***GMIR2DIRECTION:** The length of the first CL return variable below must be at least one character:
  - o N = Normal
  - o R = Reversed
  - o Blank = undetermined

- ***GMIR2NODEROLE:** This key value MUST replace any use of *PPRCNODEROLE for GMIR2 type environments, else unpredictable results may occur. The length of the first CL return variable below must be at least one character
  - o S = Source
  - o T = Target
  - o blank = undetermined.

- ***GMIR2STATE:** The length of the first CL return variable below must be at least one character
  - o 0 = Stopped
  - o 1 = Running
  - o 2 = Failover
  - o 3 = Suspended
  - o 4 = Lagging
  - o 5 = Extreme Lagging
  - o 6 = Paused

- o 9 = Other
- o M = Multi-target Incremental Resync Pair
- o blank = undetermined.

- ***GMIR2STATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
  - o State (RTNVALUE):
    - ▪ 0 = Stopped
    - ▪ 1 = Running
    - ▪ 2 = Failover
    - ▪ 3 = Suspended
    - ▪ 4 = Lagging
    - ▪ 5 = Extreme lagging
    - ▪ 6 = Paused
    - ▪ 9 = Other
  - o Direction: (RTNVALUE2):
    - ▪ M = Multi-target Incremental Resync Pair
    - ▪ N = Normal
    - ▪ R = Reversed
    - ▪ blank = undetermined

- ***IASPNAME:** The name of the Independent ASP used for the VRYCFG commands. The length of the first CL return variable below must be at least ten characters.

- ***LUNCONNECTION:** The length of the first CL return variable below must be at least one character.
  - o P = Connected to the Production Node
  - o H = Connected to the HA node
  - o Blank = undetermined

- ***LUNNODEROLE:** The values indicate the normal role of this node. The length of the first CL return variable below must be at least one character.
  - o P = Production Node
  - o H = HA node
  - o Blank = undetermined

- ***MMIRDIRECTION:** The length of the first CL return variable below much be at least one character.
  - o N = Normal
  - o R = Reversed
  - o Blank = undetermined

- ***MMIRNODEROLE:** This key value should replace any use of *PPRCNODEROLE for MMIR type environments. The length of the first CL return variable below must be at least one character.

- o S = Source
- o T = Target
- o Blank = undetermined

- ***MMIRSTATE:** The length of the first CL return variable below must be at least one character.
  - o 0 = Failed
  - o 1 = Running
  - o 2 = Failover
  - o 3 = Suspended
  - o 4 = Resuming
  - o 6 = Paused
  - o M = Multi-target Incremental Resync Pair
  - o blank = undetermined.

- ***MMIRSTATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
  - o States:
    - ▪ 0 = Failed
    - ▪ 1 = Running
    - ▪ 2 = Failover
    - ▪ 3 = Suspended
    - ▪ 6 = Paused
    - ▪ M = Multi-target Incremental Resync Pair
    - ▪ blank = undetermined.
  - o Directions:
    - ▪ N = Normal
    - ▪ R = Reversed
    - ▪ blank = undetermined.

- ***MMIR2DIRECTION:** The length of the first CL return variable below must be at least one character.
  - o N = Normal
  - o R = Reversed
  - o blank = undetermined.

- ***MMIR2NODEROLE:** This key value should replace any use of *PPRCNODEROLE for MMIR2 type environments. The length of the first CL return variable below must be at least one character.
  - o S = Source
  - o T = Target
  - o blank = undetermined.

- ***MMIR2STATE:** The length of the first CL return variable below must be at least one character.

- o 0 = Failed
- o 1 = Running
- o 2 = Failover
- o 3 = Suspended
- o 4 = Resuming
- o 6 = Paused
- o M = Multi-target Incremental Resync Pair
- o blank = undetermined

- ***MMIR2STATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
  - o States:
    - 0 = Failed
    - 1 = Running
    - 2 = Failover
    - 3 = Suspended
    - 6 = Paused
    - M = Multi-target Incremental Resync Pair
    - blank = undetermined.
  - o Directions:
    - N = Normal
    - R = Reversed
    - blank = undetermined.

- ***MMIR3DIRECTION:** The length of the first CL return variable below must be at least one character.
  - o N = Normal
  - o R = Reversed
  - o blank = undetermined.

- ***MMIR3NODEROLE:** This key value should replace any use of *PPRCNODEROLE for MMIR3 type environments. The length of the first CL return variable below must be at least one character.
  - o S = Source
  - o T = Target
  - o blank = undetermined.

- ***MMIR3STATE:** The length of the first CL return variable below must be at least one character.
  - o 0 = Failed
  - o 1 = Running
  - o 2 = Failover
  - o 3 = Suspended
  - o 4 = Resuming
  - o 6 = Paused

- o   M = Multi-target Incremental Resync Pair
- o   blank = undetermined

- ***MMIR3STATEDIRECT:** State is returned in RTNVALUE and direction is returned in RTNVALUE2. The length of first and second CL return variables below must be at least one character.
  - o   States:
    - ▪   0 = Failed
    - ▪   1 = Running
    - ▪   2 = Failover
    - ▪   3 = Suspended
    - ▪   6 = Paused
    - ▪   M = Multi-target Incremental Resync Pair
    - ▪   blank = undetermined.
  - o   Directions:
    - ▪   N = Normal
    - ▪   R = Reversed
    - ▪   blank = undetermined.

- ***MULTITARGET**: Multi-target configuration
  - o   N = None
  - o   M = Multi-target using two Metro Mirror environments
  - o   G = Multi-target using one Metro Mirror environment and one Global Mirror environment.

- ***PPRCNODEROLE:** The length of the first CL return variable below must be at least one character.
  - o   S = Source
  - o   T = Target
  - o   blank = undetermined

- ***PPRCNODES:** The backup PPRC node names for the up to three PPRC configurations. RTNVALUE will contain the MMIR configuration node name. RTNVALUE2 will contain the GMIR configuration node name. RTNVALUE3 will contain the LUN configuration node name. All three CL return variables must be specified and each of their lengths must be at least eight characters.

- **PPRCNODE:** The Production node name. RTNVALUE will contain the node name. The CL return variable must be specified with a length of at least eight characters.

Return value: This is a required parameter. Specifies a CL character variable name for returned value.

Return value 2: This is a required parameter for *MMIRSTATEDIRECT, *GMIRSTATEDIRECT, *FLASHNODES and *PPRCNODES. For *MMIRSTATEDIRECT and *GMIRSTATEDIRECT, the PPRC direction ('N' or 'R') is returned here. For *FLASHNODES, the second FlashCopy node will be

returned here. For *PPRCNODES, the GMIR target node will be returned here. Specifies a CL character variable name for the second returned value.

Return value 3: This is a required parameter for *FLASHNODES and *PPRCNODES. Specifies a CL character variable name for the third returned value. For *FLASHNODES, the third FlashCopy node will be returned here. For *PPRCNODES, the LUN HA node will be returned here.

Return value 4: This is a required parameter for *FLASHNODES if a forth FlashCopy environment is configured. Specifies a CL character variable name for the fourth returned value. The fourth FlashCopy node will be returned here.

Return value 5: This is a required parameter for *FLASHNODES if a fifth FlashCopy environment is configured. Specifies a CL character variable name for the fifth returned value. The fifth FlashCopy node will be returned here.

Return value 6: This is a required parameter for *FLASHNODES if a sixth FlashCopy environment is configured. Specifies a CL character variable name for the sixth returned value. The sixth FlashCopy node will be returned here.

RUNDSCMD - Run DS Scripted Command

The RUNDSCMD command is used in a CL program to run a scripted command through DSCLI and validate the results from the expected result list provided in the command parameters. The command optionally returns the total of numeric values in a specified column of the results.

Three exception messages may be issued:

- IAS0301 - Parameter error detected.

- IAS0302 - Result file error detected.

- IAS0303 - Results not as expected.

Script input file: The complete path and name of the script stream file. A value of '*' is allowed when no script is to be executed, and only prior results are to be validated.

Profile input file: The complete path and name of the profile stream file. A value of '*' is allowed when that value is also used for the script parameter.

Results output file: The complete path and name of the results stream file. This parameter is always required.

User: Specify the user profile name to be used to run the DSCLI scripted command.

Result validation list: A list of from one to ten validation entries to be matched against the results returned by the scripted command. The columns in the result file must be comma separated (refer to the profile that is in use).

Each validation list entry contains two or three elements:

- **Column position:** The comma separated column position for this element. This required value must be from one through 20.

- **Expected value:** The case sensitive character string that is expected. This value is required, must be enclosed in apostrophes, and may contain alphanumeric characters, blanks and punctuation marks except commas. Strings that are not to be found may be specified by placing a minus sign (-) as the first character of the string.

- **Logic to next in list:** The locical operator (*AND or *OR) to the next expected value in the list. This value is required on all list elements except the last. Note that the results of each file row are evaluated from the first to the last expected value. Careful consideration must be made when this value is mixed (both *AND and *OR used on a single RUNDSCMD command). If more complex result checking is required, the RUNDSCMD command may be run again specifying '*' for the SCRIPT parameter and combined results may be evaluated within the user's CL program.

Result file rows: The rows that are to be validated. The possible values are:

- ***ALL**: The results specified in the validation list are expected to be found in at all of the result file rows.

- ***ONE:** The results specified in the validation list are expected to be found in at least one of the result file rows.

Summation column: The comma separated column positional value that is to be summed and returned in the TOTAL parameter. Numeric values from one through 20 are allowed. The default is *NONE. If a numeric value is specified, the content of that column in the result file may only contain numeric data.

CL variable for returned total: Specifies the name of the CL program variable that receives the total value being returned. The type and length for the CL variable must be TYPE(*DEC) LEN(9 0). This parameter is required when the value of SUMCOLUMN is other than *NONE.

Return column: The comma separated column positional value that is to be returned in the RTNVALUE parameter. Numeric values from one through 20 are allowed. The default is *NONE. Refer to the RTNKEY parameter below. This parameter is requires that the RTNCOLUMN parameter is also specified.

Return key value: Specifies the key string used to locate the row in the result file where the return value (RTNVALUE) will be extracted. The default is *NONE.If a numeric value is specified for RTNCOLUMN and this parameter is *NONE, the value in the first row of the result file is returned in RTNVALUE. If a numeric value is specified for RTNCOLUMN and this parameter specifies a key value, the value in the first row of the result file that contains that key is returned in RTNVALUE. This parameter is requires that the RTNCOLUMN and RTNVALUE parameters are also specified.

CL variable for returned value: Specifies the name of the CL program variable that receives the character value being returned. The type and length for the CL variable must be TYPE(*CHAR) LEN(80). This parameter requires that the RTNCOLUMN parameter is also specified.

RUNLPARCMD - Run command based on LPAR/SRLN

This command will run a specific command based on the specified LPAR and serial numbers detected. This command is usually used in the startup program to perform different tasks based on the serial and LPAR numbers.

NOTE: It is possible to test the behavior of this command on different serial and LPAR numbers by creating the following data areas:

> CRTDTAARA DTAARA(QZRDHASM/FAKELPAR) TYPE(*CHAR) LEN(3) VALUE('123')

> CRTDTAARA DTAARA(QZRDHASM/FAKESRLN) TYPE(*CHAR) LEN(8) VALUE('1234567')

The command RUNLPARCMD will look for these data areas and use them instead of detecting the actual serial or LPAR numbers.

Serial number: Specify the serial number required to run this command. NOTE: Prompt (F4) to see the current serial number.

- ***ANY:** Run this command on any LPAR, regardless of serial number.

- **Serial-number:** Run the command on the LPAR with the specified serial number.

LPAR number: Specify the LPAR number required to run this command. NOTE: Prompt (F4) to see the current LPAR number.

- ***ANY:** Run this command on any LPAR regardless of the LPAR number.

- **lpar-number:** Run the command on the LPAR with the specified number.

Command to execute: Run this command if the LPAR and serial numbers match those of the current LPAR. NOTE: Prompt (F4) to assist with building the command.

RUNSVCCMD - Run SVC Command

This command establishes an ssh session to an SVC, runs the user entered command, and stores the results in a stream file. NOTE: This command can establish an ssh session with any type of host, not just SVCs.

Command: Specifies the command to be run.

SVC IP address: Specifies the IPv4 formatted IP address of the SVC to be used.

Results output file: Specifies the IFS path name of the output file containing the results of the SVC command.

Display results: Specifies whether the results of the SVC command should be displayed in addition to be written to the output file.

SAVDDD – Save Toolkit Device Data Domains

The Device Data Domains (DDD) are where the Toolkit stores WRKCSE, WRKCSEDTA and WRKCSECRDL information. The command SAVDDD will extract that information and place it into IFS files. Any sensitive information including passwords will be encrypted.

Use the RSTDDD command to restore / recreate the DDD information.

The sole parameter specifies the path to the directory in which to place the files. The directory must exist.

SETCSELCK - Set Copy Services Lock

This command sets a cluster wide environment lock used within IASP Copy Services Manager.

Environment name: This is a required parameter. Specifies the name of the Environment (which may be an Independent ASP).

Timeout minutes: The number of minutes before the environment lock will self time out. The default is fifteen minutes.

SETDDDLCK - Set DDD lock holder

This is a utility command for setting the job and user who holds a cluster-wide lock on a specified artifact.

Name: Enter the name of the object to display a lock for.

Type: Enter the type of object to display a lock for.

SETUPFSFC - Set up IBM Pwr HA tools – FSFC

This command prepares IBM Power HA toolkit for IBM i for Full System FlashCopy operation after its has operational library (QZRDHASM) has been restored. Caution should be taken before running this command.

Node Role: Special values indicating which role the system will be acting. The possible values are:

- ***CTL:** The system is a controlling node in Full System FlashCopy.

- ***SRC:** The system is the source LPAR in Full System FlashCopy.

FSFC Communications Port: The port to which the production node will be using for communications. This value must match the FSFC communications port value specified in either CRTCSEDTA or CHGCSEDTA that is run on the controlling node. The possible values are:

- ***SAME:** The value does not change. This is the only valid value for NODETYPE(*CTL)

- ***DFT:** The default port (55920) will be used.

- **1 – 65535:** Specify the port number that is to be used.

Toolkit access code: A hexadecimal character representation of a Product Access Code supplied by IBM. Specify the access code within single quotes. The access code must be provided in order to authorize any Full System FlashCopy operations. The access code may be entered on this command or entered on the ADDPRDACS CL command. If access code was previously entered, it does not need to be entered again.

Target line description: Line description to be created on the target LPAR for communicating with the controlling node. The possible values are:

- ***NONE:** No line description will be created

- **Name:** The name of line description to be created.

Target TCP/IP interface: TCP/IP interface to be created on the target LPAR for communicating with the controlling node. The possible values are:

- ***NONE:** No interface will be created

- **IPv4 address:** IPv4 formatted interface to be created.

Target TCP/IP interface Mask: The subnet mask of the TCP/IP interface to be created on the target LPAR. The possible values are:

- ***NONE:** No subnet mask provided
- **IPv4 address:** IPv4 formatted subnet mask.

STRFSFLASH - Start Full System Flash

This interactive command starts a Full System Flash Copy (FSFC) or Recovery Point Flash (RPF), as determined by the CSE Data it is performed on. For RPF it will create the flashcopy. For FSFC it will also perform the backup commands specified for the CSE Data. Use WRKCSEDTA or CRTCSEDTA and CHGCSEDTA to configure the FSFC or RPF.

STRFSFLASH for FSFC will perform these steps:

- Power down the target partition, if not already down,

- Flush memory in the source partition using a method specified in the CSE Data.

- Perform the flash of the external storage.

- Activate the source partition if not already up.

- Activate the target partition.

- Perform the backups on the backup partition.

STRFSFLASH for RPF will perform these steps:

- Flush memory in the source partition using a method specified in the CSE Data.

- Perform the flash of the external storage.

- Activate the source partition if not already up.

CSE Data name: Specify the name of the CSE Data that contains configuration information for the FlashCopy to be performed.

Controller IP address: Specifies the IP address on the controlling node where the processing for the STRFSFLASH command will be performed. The possible values are:

- ***LOCAL:** The local system is the controller.

- **IP address:** IPv4 formatted address

Controller port: The port on which the controller is listening for remote commands. This parameter is ignored for CTLR(*LOCAL).

STRGMTGTFL - Start a GMIR Target Flash

This command starts Global Mirroring enviromnent D-Copy Target FlashCopy Backup as defined by the WRKCSE GMIR environment.

Environment name: This is a required parameter.Specifies the name of the environment for which the backup is to be started.

CSE Data name: Specifies the name of the CSE Data used for the flash. The possible values are:

- ***ENV:** Use the CSE data that is named the same as the environment
- **Name:** The name of a specific CSE data

SWRCYPNT – Switch Recovery Point Copy

The Switch Recovery Point Copy (SWRCYPNT) command causes the Production Node to be powered down, the host connections to be changed to another set of LUNs to which previously a recovery point copy had been written, and the production node powered back up.

Switch option (SWITCHTYPE): The possible values are:

- ***SCHEDULED:** This CSE switch is planned. The Production system is available.

- ***UNSCHEDULED:** This CSE switch is not planned. The Production system is not available.

VIEWLOG - View Log File

This interactive command allows editing of the Advanced Copy Services log file on the local system and displaying the same on another system. This utility can also view any stream file on the systems.

System name: The system where the file is located. The possible values are:

- ***LOCAL:** View the main log file on the local system.

- ***SNMP:** View the SNMP log file on the local system.

- **System name:** View the main log file on the named system.

Stream file: The specific file to be viewed. The possible values are:

- ***SNMP**: View the SNMP log file. This option allows the SNMP log file on another system to be viewed.

- **Path and name of the stream file:** The default is /QIBM/Qzrdhasm/qzrdhasm.log

WRKCSE - Work with Copy Services Environment

This interactive command allows creation and editing of Flash Copy, Metro-Mirroring, Global-Mirroring and LUN environments defined for use within IBM i Copy Services Manager. Menus are also provided for basic operations. The information is retained in cluster Device Domain Data associated with IBM i Copy Services Manager.

There are no command parameters.

WRKCSECRDL - Work with CSE Credential List

This interactive command allows addition, editing, and removal of user credentials needed to establish SSH sessions with a host. Normally the host will be either a SAN Volume Controller (SVC) or a Hardware Management Console (HMC). The information is encrypted using a cryptographic derived 128 bit AES key and retained in cluster Device Domain Data associated with IBM i Copy Services Manager.

There are no command parameters.

WRKCSEDTA -Work with IBM i CSE Data

This interactive command provides basic operation to manage CSE Data used for Metro-Mirroring, Global-Mirroring, and Flash environments defined for use within IBM i Copy Services Manager.

Select: Select which CSE Data entries are to be displayed. The possible values are:

- ***CRG:** Display only the CSE Data entries that are complete.

- ***ALL:** Display all CSE Data entries.

ZAPDDDLCK - Zap DDD lock

This is a utility command for releasing the job and user who holds a cluster-wide lock on a specified artifact.

Name: Enter the name of the object to display a lock for.

Type: Enter the type of object to display a lock for.

Exit Program and Points

The FSFC Exit Program is specified on the CHGCSEDTA parameter and the compiled program must exist on both the source and controlling LPAR (but it can have different contents). This source code is supplied for example and testing purposes only. If modifications are to be made, this source member should be copied it to a library other than QZRDHASM and the modifications made there. Otherwise revised source code may be overlayed by a restore of the QZRDHASM library.

The chart below indicates where and when each exit is called, from top (beginning) to the bottom (end). Some calls are asynchronous, i.e. submitted to another job, and will not block current toolkit operations. When the calls are synchronous they are performed inline with the toolkit, and toolkit operations will not continue until the exit program returns control to the caller, and if the exit program issues an escape message the toolkit will exit with and error. Most exit points are made with the user profile of the caller to the toolkit.

	CTL	SRC	TRG	SBMJOB	Comment
*PRECHKCTL	X				
*PRECHKSRC		X			CHKFSFLASH, STRFSFLASH
*PREPFLASH	X				Not if Flush = *IPL
*QUIESCE		X			Not if Flush = *IPL
*PREFLASH	X				Not if Flush = *IPL
*QUIESCED		X			Not if Flush = *IPL, *FRCWRT
*POSTFLASH		X		SBMJOB	Not if Flush = *IPL
*PSTFLASH2	X			SBMJOB	Not if Flush = *IPL
*PAUSED	X			SBMJOB	Only for SWRCYPNT
*PREIPL	X				Only for SWRCYPNT
*TGTPREIPL	X				Only for STRFSFLASH
*PRETCPCFG			X		
*CMNHDWRSC			X		
*STRRSTD	X			SBMJOB	BRMS = *YES, SAVSYS, repeats
*ENDRSTD	X			SBMJOB	BRMS = *YES, SAVSYS, repeats
*TGTPSTTCP			X		
*TGTBRMSAV			X		BRMS = *YES
*PSTBKUTGT			X	SBMJOB	
*PREMERGE		X			BRMS = *YES, *CHGONLY
*MERGE1		X		SBMJOB	BRMS = *YES, *CHGONLY
*MERGE2		X		SBMJOB	BRMS = *YES, *CHGONLY
*MERGE3		X		SBMJOB	BRMS = *YES, *CHGONLY
*POSTMERGE		X			BRMS = *YES, *CHGONLY
*FINISH		X		SBMJOB	BRMS = *YES or Flush = *IPL
*PWRDWNTGT	X				Restart target after FC = *YES *AND Stop target after backup = *YES